ABSTRACT

One of the most frequently used communication presentation tools is PowerPoint. This tool is widely utilized on all levels in businesses. Students receive lectures made with PowerPoint, and also learn how to use it themselves during their studies. PowerPoint has become a standard tool for presentations and has been criticized by some scientists, such as Tufte (2006). He wrote an essay on this subject called “The Cognitive Style of PowerPoint” [10]. This essay can also be found in his book “Beautiful Evidence” [11], this book contains several articles and essays on evidence presentation. This research will focus on exploring the problems Tufte (2006) describes for using PowerPoint as a business and technical communications tool according. There will also be a comparative case study on the extent of which two IT Consultancy companies actually encounter the problems described by Tufte (2006) on the use of PowerPoint as a business and communications tool.

Keywords
PowerPoint, PowerPoint, cognitive overload, presentation, Tufte

1. INTRODUCTION

PowerPoint has increasingly become the most common tool used for business and technical communications. From schools to working places, it has integrated to be the standard software utilized for presentations. Some of the most important decisions are made based on PowerPoint presentations. According to some researchers this shift in communications can have dire consequences. They blame a number of corporate and technical disasters on PowerPoint that is used to deliver the important information to decision makers, and in the end resulting in bad decisions. A renowned critic of PowerPoint is Tufte (2006). Heblames the use of PowerPoint for the Columbia shuttle accident in 2003. The fact, that PowerPoint has limited abilities to show high densities of information, and the hierarchical bullets-style of PowerPoint among others, are to be blamed for the inaccurate decision-making on the Columbia shuttle issue, which lead to the disastrous incident [11].

Furthermore, Tufte (2006) shows that high density of data cannot be shown in slides with his investigation on the performance of PowerPoint for statistical data [11]. Applying the default PowerPoint templates for statistical graphics will generate incoherent graphs. The slides do not provide a good oversight of the data. The fact that PowerPoint splits up the data from the example into six slides, makes it harder to understand the data. Consequently, the results become uncomparable and the data-density becomes low.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

Moreover not much scientific literature describes how to effectively use PowerPoint as a business and technical communications tool. The examples mentioned above demonstrate the importance of investigating more on this topic.

2. RESEARCH STRUCTURE

This chapter contains the research structure that will be used for this research. First the research question will be formulated; this will contain the purpose of the research. In the second part of the chapter the methodology, that is going to be used for the research, will be described. Then the results of the research will be shown in the paper, followed by conclusions and further research.

2.1 Research question


To achieve this goal some questions need answering, starting with a literature study to find what so far has been written about the use of PowerPoint. Then critically compare the acquired information with what Tufte (2006)’s ideas are on the matter.

After analyzing the problems Tufte (2006) describes in his work the results can be analyzed in the case study. As the case study will be done in an IT-consultancy company, the internal and external communications will be evaluated separately. Further it will be interesting to investigate if at different stages of the project the use of PowerPoint will change. As mentioned earlier the main goal of doing the case study will be to see if the IT-consultancy company encounters the same problems as Tufte (2006) sees in his essay, on the use of PowerPoint as a business and technical communications tool.

From these steps the following sub questions can be derived:

2. What does other literature say about the problem areas of using PowerPoint as a business and technical communications tool as mentioned by Tufte?


2.2 Research methods
The research methods that will be used for the research are literature research and a case study. Knowing what is already written is important before doing research. Using the limited existing literature on the use of PowerPoint as a business and technical communications tool, will be a good addition to what has been written in the book “Beautiful Evidence” [11] about this subject. This way a critical review on Tufte (2006)’s essay can be made. Moreover, more literature may be found to strengthen or contradict Tufte (2006)’s view on the usage of PowerPoint as a business and communications tool. Literature will be found through the following databases: Ingenta [6] and ACM guide [1] these two search engines cover the top IS journals [8]. Because we want to find more about the use of PowerPoint as a communications tool, the following search queries will be used to find articles. For Ingenta [6] the queries (PowerPoint OR "PowerPoint") AND communication and (PowerPoint OR "PowerPoint") AND (use OR usage) were used. The reason the query is split up into two parts is because using the first query gives only a few hits. In ACM guide [1] the first query gave more hits, both queries were used to find articles. In search for more articles, looking for alternative words is a way to try to find more articles. An alternative for the PowerPoint would be slideware or “multimedia presentation”. To incorporate these alternatives the following queries are formulated: (slideware OR (multimedia AND presentation)) AND communication and (multimedia AND presentation) AND (use OR usage). These queries lead to some more articles. Another aspect is the Cognitive Overload theory, to find information about this subject the following query has been used cognitive AND overload.

Due to the limited amount of literature on this subject, it will be most interesting to perform a case study. Furthermore it will be interesting to see if companies encounter the same problems as Tufte (2006) describes in his book “Beautiful Evidence” [11]. Other interesting subjects are if there are differences between internal and external use of PowerPoint within the company, differences between departments and their use of PowerPoint as a communications tool and if there are differences in the use of PowerPoint as a communications tool in different phases of projects that the companies is working on. Because Tufte (2006) mainly based his findings on the Columbia shuttle case, a case study in another kind of environment will become a suitable base to find evidence to support or to contradict what Tufte (2006) has written in his book “Beautiful Evidence” [11]. If needed the guidelines will of course be adjusted conform the findings in the case study. The following data collection methods will be used in the case study: interviews and an analysis of the documents by the company. Analysis of the documentations and interviews will be important to understand the use of communications in the company, in a broader context. This should lead to an understanding to the extent to which PowerPoint is used as business and technical communications tool in the company. The paper “Successfully completing case study research: combining rigour, relevance and pragmatism” [4] by Dark et al (1998) on conducting case studies on an information systems context and the book “Case study research: design and methods” [12] by Yin (2003) will give a good guideline on how to set up case studies.

3. Problems with PowerPoint as a business and technical communications tool.
The book “Beautiful Evidence” [11] describes several phenomena concerning problems with information gathering, presentation and communication. In the first part of this chapter these phenomena are described and marked italic. Another problem that Tufte (2006) describes related more directly towards PowerPoint. This problem is the cognitive style imposed by PowerPoint. Each new technology embodies a form of thinking that orients a person to approach the world in a particular way [2], this is also true for PowerPoint. Tufte (2006) describes that the cognitive style that PowerPoint imposes on the presenter is a big problem in the use of PowerPoint as a communications tool. In the essay “The Cognitive Style of PowerPoint” [11, p158] Tufte (2006) describes these cognitive styles imposed by PowerPoint. These cognitive styles are described in the last part of this chapter and are marked italic. As some styles are related to each other these related styles have been grouped together into a problem area.

3.1 Problem Area – Effect without causes
The usage of bullets promotes effects without causes, because the use of bullets causes fragmented statements in presentations. This will lead to an unclear formulation of the what, how, when and where, so it will become unclear who the agents are of the actions described. Another problem with bullets is they lack the means to show relations between the different objects listed, schemas however can show these relations between different objects [11, p143].

How often bullet points are used on slides will be an indirect indication of the amount of the problem area effect without causes. This will be measured by the average number of slides containing bullet points.

3.2 Problem Area – Cherry-picking
The phenomenon cherry-picking, is an obstacle to learning the truth from an evidence-based report. The presenter picks and chooses, selects and reveals only the evidence that advances their point of view [11, p144]. A clear sign of cherry-picking is that a report appears to be too good to be true, because reports will be written to the expectations of the readers. Despite any guidelines to reports, cherry-picking will be virtually impossible to counter. This is because the writers will keep coming up with imaginative new methods for cherry-picking data [11, p145]. The integrity of a report depends in part on the integrity of the process of evidence construction. See figure 1 for a model of the process of evidence construction and presentation.
This problem area is not measurable without an in-depth analysis of the content of the presentation including relevant background information, therefore this falls out of the scope of this research paper.

3.3 Problem Area – Punning

"Economisting (e kon’ o mist’ ing) 1. The act or process of converting limited evidence into grand claims by means of punning, multiplicity of meaning, and overreaching. 2. The believe or practice that empirical evidence can only confirm and never disconfirm a favored theory. 3. Conclusions that are theory-driven, not evidence-based.” – Tufte (2006) [11, p149].

Because of punning, the use of metaphors will lead to a drift of the meaning of the words into duplicity. Wrongfully using synonyms can lead to misinterpretation and economisting.

This problem area is not measurable without an in-depth analysis of the content of the presentation, and falls out of the scope of this paper.

3.4 Problem Area – Chartjunk

“Chartjunk flows from the premise that audiences can be charmed, distracted, or fooled by means of content–free misdirection.” – Tufte (2006) [11, p152]. Chartjunk can be defined as all ingredients of a figure that do not convey information [9]. There are two different forms of chartjunk described by Tufte (2006).

The first form is called chartjunk of garish decoration, here the use of decoration of charts is more important then the correct display of evidence. This will of course have an impact on the quality of the presentation [11]. Especially when using non-functional animations, this will generally lead to a shift of attention the object in motion [5]. More importantly attention will be generally locked when processing motion, using animation may be unwarranted if the object is not important; tracking may prevent other fixations [5].

The second type of chartjunk is called chartjunk of graph bureaucracy, referring to the use of redundant representation of data or presenting the data in an unclear way. This will lead to data that is hard to interpret.

This problem area can be measured by analyzing the amount of figures, graphs and other graphical content that are not useful for the presentation and compare this with the number of tables, graphs and figures that are useful.

3.5 Problem Area – Rage to conclude

The last phenomenon described by Tufte (2006) is a persistent rage to conclude. Tufte (2006) describes this as the phenomenon where people deny the implications, complexities and uncertainties of primary evidence [11, p154]. The repacking of information will lead to corruption of the information. It adds its own special interpretive filter to the critical process of from evidence. Secondary bureaucracies of presentation might lack the technical skills and substantive knowledge to detect their mistakes. [11, p154] This process can be seen in figure 2.

This problem area is not measurable without an in-depth analysis of the content of the presentation, and falls out of the scope of this paper.

3.6 Problem Area – Focus on presentation, not content

PowerPoint is presenter orientated and not content orientated, not audience orientated. Because of this PowerPoint is designed and advertised for the presenter, a tool to make it easier for the presenter to overcome presentation jitters.

A high level of commercialism turns information into a sales pitch and presenters into marketers, causing a preoccupation with format not content. Examples of this are for sighting of evidence and thought, logo branding of slides with logotypes [11].

Logo branding on master slide level will be an indication of the commercialism Tufte describes in this problem area. This will be measured by an estimate, in percentage, of the area which the logo takes up of the total surface of the slide on template level.

3.7 Problem Area – Low spatial resolution

PowerPoint has a low spatial resolution, this is caused by the use of beamers. The usage of beamers makes the use of large fonts to keep the information readable necessary. This causes PowerPoint to have little room for information [9]. The low spatial resolution will lead to abbreviations of sentences and will promote effects without causes and bad phrasing of sentences [11].

An indicator of this problem area is the information density of the slides, measured by counting the number of words on the slides per minute. The actual information conveyed during the presentation will also be observed, by using the number of orally spoken words as an indicator. This will be done by averaging multiple 1-minute period measurements of the number of words spoken during the presentation. By comparing these indicators insight can be given on the actual information
The potential problem, called **incorporate other logical structures and the hierarchical structures: sequence (first to last in time), priority (least to most important or vice versa) or simple membership to a set (these items relate to one another in some way, but the nature of that relationship remains unstated)** [11]. This makes it hard to convey the integrity of the evidence by setting the points the presenter thinks is more important upfront. This may lead to miscommunication can be toxic to an organization's bottom strategic risk for every organization. PowerPoint-based presentations, some of their findings support the findings of Mayer and Moreno (2003).

### 3.8 Problem Area – Hierarchical Structure

The hierarchical structure makes it easy for the presenter to corrupt the integrity of the evidence by setting the points the presenter thinks is more important upfront. This may lead to bad decision making as Tufte (2006) tries to point out with his essay “The Cognitive Style of PowerPoint” [10] in the case of the Columbia shuttle accident.

The use of bullets can communicate only three logical structures: sequence (first to last in time), priority (least to most important or vice versa) or simple membership to a set (these items relate to one another in some way, but the nature of that relationship remains unstated) [11]. This makes it hard to incorporate other logical structures and the hierarchical structure is used by default, before presenters think about using other structures.

How often bullet points are used in the slides will be an indirect indication of the amount of the problem Hierarchical Structure. The following values will be collected to get an overview of how often bullet points are used in the presentation, the average level of bullet points used per slide, the minimum and maximum level of bullet points used on one slide in the presentation.

### 3.9 Problem Area – Cognitive overload

The potential problem, called **cognitive overload**, that the processing demands evoked by the learning task may exceed the processing capacity of the cognitive system [7] is contrary to the recommendations by Tufte (2006) to put more information onto slides. Mayer and Moreno (2003) have defined different kinds of cognitive overload. Here are the descriptions of the effects that Mayer and Moreno (2003) have described in their research [7]. Faraday and Sutcliffe (1997) did research on attending and comprehending multimedia presentations, some of their findings support the findings of Mayer and Moreno (2003).

1. **Modality effect**: There is better information transfer when words are presented as narration rather than as on-screen text. This effect is contradicted by Faraday and Sutcliffe, in their research they found that recall of propositions which were only given in speech track was generally poor. They found that generally if the speech information is complex or important then it may be best to also concurrently present it in a caption [5, p271].

2. **Segmentation effect**: There is better information transfer when the lesson is presented in learner-controlled segments rather than as a continuous unit. This effect is supported by research done by Faraday and Sutcliffe (1997) [5, p270].

3. **Pretraining effect**: There is better information transfer when students know names and behaviors of the system components.

4. **Coherence effect**: There is better information transfer when extraneous material is excluded.

5. **Signaling effect**: There is better information transfer when signals are included.

6. **Spatial contiguity effect**: There is better information transfer when printed words are placed near responding parts of graphics. This effect is supported by research done by Faraday and Sutcliffe (1997) [5, p272].

7. **Redundancy effect**: There is better information transfer when words are presented as narration rather narration and on-screen text. This effect is supported by research done by Faraday and Sutcliffe (1997) [5, p272].

8. **Temporal contiguity effect**: There is better information transfer when corresponding animation and narration are presented simultaneously. This effect is supported by research done by Faraday and Sutcliffe (1997) [5, p271].

9. **Spatial ability effect**: High spatial learners benefit more from well-designed instructions than do low spatial learners. This effect is supported by research done by Faraday and Sutcliffe (1997) [5, p272].

PowerPoint may lead to cognitive overload which in turn will lead to ineffective communication and presents a major strategic risk for every organization. PowerPoint-based miscommunication can be toxic to an organization’s bottom line. [3] This problem area is not measurable without an in-depth analysis of the content of the presentation, and researching the information processing of the attendees of the presentations, this falls out of the scope of this research paper.

### 4. Case Study

The presented problem areas are researched by observations, interviews and reviewing artifacts.

The objective of the case study is to review the presence of the problem areas Tufte has mentioned in “The Cognitive Style of PowerPoint” [10] in companies. In the next section the data that has been collected from two IT consultancy companies will be analyzed.

The interviews will give insight on how people in the organization experience the use of the Power Point in the organization themselves, on the one hand as listeners to presentations and on the other hand as presenter giving presentations. This should give us insight on whether or not the users of PowerPoint actually experience the problem areas as Tufte describes. More over will interview give insight on the usage of PowerPoint in their organization in the view of the people in the organization. The interview questions can be found in Appendix B.

By observing presentations insight will be gained in the number of words conveyed in the actual presentation and this can be compared to the number of words on the slides. This will give insight on the amount of extra information that is conveyed verbally that is not available on the slides.

The artifacts, the PowerPoint slides, will give us insight on the amount of words used in the slides, the amount of chartjunk and unnecessary usage of slide junk.

### 5. Results

The results of the case study will be reviewed in this section. Table 1 shows the sources of data used in the case study.

<table>
<thead>
<tr>
<th>Company 1</th>
<th>Company 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size = 3 PowerPoint slides</td>
<td>Sample size = 10 PowerPoint slides</td>
</tr>
<tr>
<td>Sample size = 1 PowerPoint slides</td>
<td>Sample size = 3 PowerPoint slides</td>
</tr>
</tbody>
</table>

For the problem area Low spatial resolution some of the data are based on presentations observed with corresponding Power Point slide; for company 1 the sample size = 3 presentations
with corresponding PowerPoint slide and for company 2 the sample size = 2 presentations with corresponding PowerPoint slide.

Table 1: Sources of data

<table>
<thead>
<tr>
<th>Problem area</th>
<th>Average of all the PowerPoint slides analyzed at the company</th>
<th>Presentation observed with corresponding PowerPoint slide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect without causes</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Cherry picking</td>
<td>Out of scope</td>
<td></td>
</tr>
<tr>
<td>Punning</td>
<td>Out of scope</td>
<td></td>
</tr>
<tr>
<td>Chart junk</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Use of visuals</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Rage to conclude</td>
<td>Out of scope</td>
<td></td>
</tr>
<tr>
<td>Focus on presentation, not content</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Low spatial resolution</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hierarchical structure</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Cognitive overload</td>
<td>Out of scope</td>
<td></td>
</tr>
</tbody>
</table>

Besides the PowerPoint slides and the observations, interviews have also been done. For company 1, 6 interviews have been done and for company 2, there have been 3 interviews.

Next per problem area the results from the case study will be reviewed. Followed by the results of the interviews.

5.1 Effect without cause
The percentage of slides containing bullet points is an indirect indicator of the problem area effect without causes.

Table 2: Results Effect without cause

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Company 1 (39.55%)</th>
<th>Company 2 (32.10%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of slides containing bullet points</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When comparing the two companies the number of slides containing bullet points, both nearly have 1/3rd (39.55% for company 1 and 32.10% for company 2) of their slides containing bullet points. Company 1 uses slightly more bullet points in their slides compared to company 2.

One of the interviewees of company 1 mentioned that due to the use of bullet points sometimes leads to the reading off of the slides instead of telling a story during the presentation. Another interviewee of company 1 mentions that the use of Bullet Points are annoying to listen too, because of its summary nature and doesn't add anything to the presentation.

This implies that the existence of Bullet Points in PowerPoint has an impact on the use of PowerPoint, as both companies use Bullet Points on 1/3rd of their PowerPoint slides. It also appears that Bullet Points impact the experience of some listeners to presentations.

5.2 Chartjunk
The problem area of chartjunk can be explored by comparing the amount of chartjunk used and compare this with the amount of visuals used that are not chartjunk.

Table 3: Results Chartjunk

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Company 1 (39.55%)</th>
<th>Company 2 (32.10%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage slides containing chart junk.*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in amount of chartjunk seems quite big, where company 1 has about double the amount of chartjunk compared to company 2 (18.20% for company 1 compared to 8.64% for company 2). When further comparing this to the amount of visuals used, that is not chartjunk, we can see that the total amount of visuals used doesn’t differ that much, both have around 50% of their slides containing visuals that are not chartjunk (respectively 44.29% for company 1 and 53.09% for company 2). When comparing the ratio of chartjunk versus visuals, that are not chartjunk, used, it’s obvious that this ratio is also a lot bigger for company 1 than two, because of the higher amount of chartjunked and almost similar amount of visuals used this ratio is respectively 41.08% for company 1 and 16.28% for company 2.

In the interviews the possibility of using visuals is mentioned by multiple interviewees as one of the strengths of PowerPoint. One of the interviewees mentioned the weakness of having ‘too good’ layout can be distracting.

5.3 Focus on presentation, not content

Table 4: Results Focus on presentation, not content

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Company 1 (39.55%)</th>
<th>Company 2 (32.10%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of slides containing bullet points.*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The commercialism, indicated by the estimate percentage of area of the master slide that has been used for company logo seems low in both cases, where company 1 with 2.33% has a slightly bigger use of company logo in the master slide compared to company 2 with 1.50%.

5.4 Low special resolution
An indication of low special resolution is the information density of the slides. This is measured by counting the average number of words per slide per minute of the PowerPoint presentations of which the presentations were observed.

Table 5: Results Low special resolution

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Company 1 (14.54)</th>
<th>Company 2 (41.25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average number of words on the slide per minute**</td>
<td>26.00</td>
<td>30.50</td>
</tr>
<tr>
<td>Ratio spoken words compared to words on slide**</td>
<td>7.42</td>
<td>3.62</td>
</tr>
<tr>
<td>Average number of words on slide per slide**</td>
<td>21.34</td>
<td>40.31</td>
</tr>
<tr>
<td>Average number of words on slide per slide (all slides)*</td>
<td>24.74</td>
<td>40.67</td>
</tr>
<tr>
<td>Minimal number of words on slides (all slides)*</td>
<td>2.70</td>
<td>47.40</td>
</tr>
<tr>
<td>Maximum number of words on slides (all slides)*</td>
<td>6.33</td>
<td>75.00</td>
</tr>
</tbody>
</table>
When comparing the two companies it is clear that company 2 uses more words on the slide per minute (14.54 for company 1 compared to 41.25 for company 2). Upon further examining of all the PowerPoint slides, the average number of words per slide of company 2 is also higher (21.34 for company 1 compared to 41.25 for company 2). This indicates that company 2 tends to put more words on their slides than company 1.

Looking at the oral information conveyance, the number of spoken words per minute company 1 uses slightly less words per minute (26.00 for company 1 compared to 30.50 for company 2). Consequently the ratio of spoken words compared to words on slides, because the words on slides for company 2 is higher and spoken words almost similar, the ratio spoken word compared to words on slide is higher for company 1 (7.42) compared to company 2 (3.62).

Both companies seem to convey the same amount of information orally, when looking at words per minute. The words per minute spoken during the presentation may also vary due to speaking speed of the presenter. However company 2 is putting more information in the slides themselves.

One of the interviewees from company 2 mentioned that there is limited space in PowerPoint to convey your message. This is an weakness of PowerPoint because in his company PowerPoint’s are mailed around and have remain readable without losing the story, so people won’t draw their own conclusions.

Another interviewee from company 2 mentions that the PowerPoint slides themselves stay generic, and that the actual story is told orally.

Another interviewee from company 2 mentioned that the PowerPoint slides themselves stay generic, and that the actual story is told orally.

## 5.5 Hierarchical structure

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Company 1</th>
<th>Company 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>The average level of bullet points used per slide.*</td>
<td>0.57</td>
<td>0.31</td>
</tr>
<tr>
<td>The minimum level of bullet points used on one slide in the presentation.*</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>The maximum level of bullet points used on one slide in the presentation.*</td>
<td>3 (average of 1.60)</td>
<td>2 (average of 1.00)</td>
</tr>
</tbody>
</table>

The average level of bullet points of company 1 is higher than that of company 2. When looking at the maximum and minimums there does not seem usage of deep level of bullet points. The maximum of company 1 3 levels, minimum of 0 levels and the average maximum over all the presentations analyzed for company 1 is 1.60. Compared to company 2 the maximum level is 2, minimum of 0 levels and the average is 1.00.

There does not seem to be excessive use of bullet points, even though company 1 has a maximum of 3 levels, this only one set of slides and can be considered an exception on the total of 10 PowerPoint slides examined from company 1, most slides (frequency of 6) had a maximum level of 2. Not much can be said about this in company 2, where only 3 PowerPoint slides were examined, but from the slides analyzed there is no indication that in company 2 there is a tendency to use deep levels of bullet points.

## 5.6 Interviews

In this subsection the findings of the interviews, that didn’t fit with the problem areas mentioned by Tufte are further explored.

### 5.6.1 Usability

Most interviewees from both companies agree that PowerPoint is an easy to use support tool for the structuring of presentations and can be used as visual aid, to show pictures. However one interview from company 2 mentioned that creativity is lost by the use of standard functions.

One interviewee from company 1 believes that PowerPoint can be used in a broad spectrum and believes this to be a strength. Another interviewee from company 1 however notes that sometimes diagrams are made with PowerPoint even though there are better programs for that. A third interviewee also from company 1, adds to this that, sometimes PowerPoint becomes a means by itself, he elaborates this with the example of the ‘golden hammer’, where all problems become nails, so the tool dictates how we work with it.

Another issue mentioned by an interviewee from company 2 is, that PowerPoint is sometimes treated lightly and people spend too little time on the making of the slides and resort to copy pasting. This can lead to an incoherent presentation.

On the weakness of the use of PowerPoint most interviewees agree that sometimes too much text is put on the slides. This may be connected to cognitive overload mentioned by Mayer and Moreno (2003). However because this is out of the scope of this paper, this is not investigated further.

### 5.6.2 Interaction

On the issue whether face to face meetings or documents are better, most of the interviewees from both companies nuance this and say that it depends on what you want to accomplish summarizing their arguments.

Face to face is more effective for making decisions, to go into depth and to make a point, these are processes where interaction is needed, which documents can’t provide. One interviewee from company 2 mentions that he thinks that human contact should be preserved, and that there shouldn’t be a call/mail culture in the company.

Documents on the other hand seem to be used for reference purposes, even for face-to-face meetings, written documents are sometimes written to report what has been said in the meeting.

However in the end it is a combination of both, and depending on what works best for the particular situation. Human contact seems important to some of the interviewees and interaction is possibly with face-to-face meetings. However documents can become far more detailed and can be used as reference.

### 5.6.3 PowerPoint as documentation

One of the interviewees from company 1 mentioned another strength of PowerPoint usage, namely that by using PowerPoint as support tool, there is a digital reference available. Interesting is that company 2 uses PowerPoint as a form of documentation. One interviewee of company 2 notes that making a PowerPoint document saves time compared to making a Word document. Another interviewee of company 2 brings a nuance to this perspective, this interviewee believes that people in company 2 make a conscious decision to deliver a PowerPoint document or to deliver a Word document. And yet another interviewee of company 2 indicates that sometimes the PowerPoint documents start to become book works.
Seemingly PowerPoint has become a bridge between face-to-face meetings and full documents in company 2, where PowerPoint supports the presentation and provides a platform for interaction in presentations as well, to a certain extent, reference function in the form of the digital PowerPoint slides.

5.6.4 Company guidelines for PowerPoint
Company 1 has, except for the use of common templates, no guidelines within the company, the interviewees mentioned that most of the knowledge on creating PowerPoint slides comes from their own background.

The organization of PowerPoint usage in company 2 is totally different. There are special trainings on how to create PowerPoint slides and presentations, there are internal guidelines on how to use PowerPoint, which includes the requirements of PowerPoint presentations.

6. Conclusions
The extent in which the problem areas exist in the two companies varies per problem area. However it is inconclusive in this explorative paper what levels of the problem areas can be perceived as problematic to the companies.

It appears that the problem area of 'effect without cause' exists in both companies, because both companies have nearly 1/3 of their slides containing bullet points. The interviews also indicate that the use of bullet points impacts the experience of some listeners to presentations.

The problem area of chartjunk seems to differ between the two companies. Where one company uses as much chartjunk compared to company 2.

In both organizations there seems to be a certain focus on presentation and not on presentation, as both companies have logos on their master slide.

There seems to be a big difference to the extent of the problem area ‘Low spacial resolution’ between the two companies, where company 2 puts more information in the slides than company 1.

The last problem area ‘Hierarchical structure’ doesn’t seem to exists to a high extend in both organizations, where the average level of bullet points is 1.60 levels for company 1 and 1.00 levels for company 2. So there is no indication of extensive use of deep level of hierarchical structures in both organizations.

The difference in use of visuals, chartjunk and the amount of information put in the slides may be related to organizational guidelines and culture. Company 2, who has less chartjunk and more information on the slides, has more guidelines and training for the use of PowerPoint. Indeed, it appears that company 2 has incorporated PowerPoint as an intermediate between face to face meetings and full documents.

PowerPoint seems to be a good communications tools to support presenters in meetings and support interaction between the presenter and listeners. Possibility for interaction seems to be important for many of the interviewees. The use of documents seems to be a trade off to convey more information during the presentation along with the ability to have a reference, without putting too many words onto the PowerPoint slides. Against being distracting for the listener by having documents available during the presentation and having too much information on the slides.

Lastly the way the PowerPoint slides are created appears to have an important impact on the way the listener perceives the presentation. The use of standard function of PowerPoint has impact on how PowerPoint slides are created and the use of functions like copy and paste appears to impact the experience of the presenter negatively.

7. Further research
This research has been limited to two companies and in-depth analysis of the content was not possible. It will be interesting to do the same tests over a larger population, more companies examined, more PowerPoint slides analyzed per company and more presentations observed for the companies. This may give better insight of the spectrum of the indicators used in this paper, and perhaps can lead to better comprehension of at what level the problem areas become problems to the presentation goal and the company.

More importantly will be to do in-depth content research, focusing on the content on what is written in the PowerPoint slides. This will make it possible to explore the problem areas that fell out of the scope of this paper ‘cherry-picking’, ‘punning’, ‘rage to conclude’ and ‘cognitive overload’.

These problem areas all touch the question on information comprehension, to what extend do the suggested problem area actually pose a problem, when we look at the information comprehension. The focus should be on information comprehension, as the eventual goal is to convey information from the presenter to the listeners of the presentation. It will be interesting to see if precise formulation of words and sentences will impact information comprehension positively. Will the amount of information on the slides, which this research suggested does not impact the oral information conveyed, positively impact the information comprehension? Or will cognitive overload cause an overflow of information, that leads to less comprehension? Will the use of handouts impact information comprehension positively, or will it distract people from listening to the presentation and perhaps handouts as well may lead to cognitive overload. What impact does a presentation with bullet points, compared with a presentation without bullet points, have on the information comprehension? Are the relationships implied by usage of bullet points used correctly in the slides that are examined?

Another direction that is interesting to investigate is the exact role of PowerPoint in the company, it is apparent in this study that PowerPoint seems to have two different roles in both companies. One company seems to use PowerPoint mainly to support presentations, while the other company will use PowerPoint documents as a bridge between face to face meetings and a full word document, perhaps there are even more ways to use PowerPoint in organizations. It is however most likely that the organizational culture impacts the role of PowerPoint within the organization, it can be interesting to examine the relation between organizational culture and PowerPoint usage.

Related to this is the impact of different positions in the organization towards the way people use PowerPoint. How will working in different departments within the same organization impact the use on PowerPoint? What about internal or external use of the presentation, how does that impact the use of PowerPoint?

8. References


## Appendix A

### Table 7: Data collection results

<table>
<thead>
<tr>
<th>Problem area</th>
<th>Indicator</th>
<th>Company 1</th>
<th>Company 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect without causes</td>
<td>Percentage of slides containing bullet points.*</td>
<td>39.55%</td>
<td>32.10%</td>
</tr>
<tr>
<td>Cherry picking</td>
<td>Out of scope.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Punning</td>
<td>Out of scope.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chart junk</td>
<td>Percentage slides containing chart junk.*</td>
<td>18.20%</td>
<td>8.64%</td>
</tr>
<tr>
<td>Use of visuals</td>
<td>The tables used in the slides. (non chart junk)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total # of tables used in slides.</td>
<td>1.40</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Average tables per slide.</td>
<td>9.81%</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>The graphs used in the slides. (non chart junk)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total # of graphs used in slides.</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Average graphs per slide.</td>
<td>6.29%</td>
<td>9.26%</td>
</tr>
<tr>
<td></td>
<td>The diagrams used in the slides. (non chart junk)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total # of diagrams used in slides.</td>
<td>3.60</td>
<td>9.67</td>
</tr>
<tr>
<td></td>
<td>Average diagrams per slide.</td>
<td>28.19%</td>
<td>48.83%</td>
</tr>
<tr>
<td></td>
<td>Total use of visuals. (non chart junk)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total # of visuals used in slides.</td>
<td>6.00</td>
<td>10.67</td>
</tr>
<tr>
<td></td>
<td>Average visuals per slide.</td>
<td>44.29%</td>
<td>53.09%</td>
</tr>
<tr>
<td></td>
<td>Ratio chart junk versus use of visuals (non chart junk)*</td>
<td>41.08%</td>
<td>16.28%</td>
</tr>
<tr>
<td>Rage to conclude</td>
<td>Out of scope.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focus on presentation, not</td>
<td>Estimate area logo takes up of the total surface of the slide on template</td>
<td>2.33%</td>
<td>1.50%</td>
</tr>
<tr>
<td>content</td>
<td>level.*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low spatial resolution</td>
<td>Average number of words on the slide per minute**</td>
<td>14.54</td>
<td>41.25</td>
</tr>
<tr>
<td></td>
<td>Average number of spoken words per minute**</td>
<td>26.00</td>
<td>30.50</td>
</tr>
<tr>
<td></td>
<td>Ratio spoken words compared to words on slide**</td>
<td>7.42</td>
<td>3.62</td>
</tr>
<tr>
<td></td>
<td>Average number of words on slide per slide**</td>
<td>21.34</td>
<td>40.31</td>
</tr>
<tr>
<td></td>
<td>Average number of words on slide per slide (all slides)*</td>
<td>24.74</td>
<td>40.67</td>
</tr>
<tr>
<td></td>
<td>Minimal number of words on slides (all slides)*</td>
<td>2.70</td>
<td>47.40</td>
</tr>
<tr>
<td></td>
<td>Maximum number of words on slides (all slides)*</td>
<td>6.33</td>
<td>75.00</td>
</tr>
<tr>
<td>Hierarchical structure</td>
<td>The average level of bullet points used per slide.*</td>
<td>0.57</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>The minimum level of bullet points used on one slide in the presentation.*</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>The maximum level of bullet points used on one slide in the presentation.*</td>
<td>3 (average of 1.60)</td>
<td>2 (average of 1.00)</td>
</tr>
<tr>
<td>Cognitive overload</td>
<td>Out of scope.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Values are average of all the PowerPoint slides analyzed at the company; for company 1 the sample size = 10 PowerPoint slides and for company 2 the sample size = 3 PowerPoint slides.

** Values based on presentation observed with corresponding PowerPoint slide; for company 1 the sample size = 3 presentations with corresponding PowerPoint slide and for company 2 the sample size = 2 presentations with corresponding PowerPoint slide.

## Appendix B

### Questions for the interview

1. What do you think about the effectiveness of PowerPoint as a communications tool?
   - What are the strengths and weaknesses?
     - As a listener
     - As a presenter
2. Do you think PowerPoint is overused?
3. What do you think is more effective, face to face meeting or using documents?
4. Are there guidelines for PowerPoint usage in your organization?