

# Information Visualization: A Case Study of Undergraduate Students

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## Abstract

This paper focuses on the various aspects of information visualization when making a professional and effective presentation. We propose a framework based two sets of factors; perfection in environmental factors and clarity in problem and solution identification in making a successful presentation. This paper removes the subjectivity associated in making consistent presenting visually by applying various scientific methods.

**Keywords:** Story telling; Visualization; Visuals; Environment; System dynamics; Aesthetics; Schema; Presentation tool

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## Introduction

Information visualization tools enable users to show simple or multimedia embedded slides on computer or on a projection system. One such tool incorporates animation, images, sounds, texts, videos and charts for an interactive experience. Presentation is also affected by system dynamics of presentation, use of visuals and the ability to manage human attention span. We also discuss the system dynamics formed of interaction between presenter, tool and the audience. This paper identifies some of the aspects of storytelling visually using the popular tool that may help in improving the user experience.

## Problem statement

Information visualization is extensively used in making presentations. Recently one such tool PowerPoint has seen an escalation in articles and studies that depict it as evil, deadly and making users stupid [1]. This paper presents the little nuances that was identified in making a presentation effective. The past research papers are overwhelmingly shadowed by Tufte's "The cognitive style of PowerPoint" research paper and New York Times article [2,3]. Here we present a new approach to make presentations that avoid these pitfalls. Out of this we propose a framework to make evaluate successful presentations.

## History of Visualization

Some of the earliest examples of storytelling using visualization are seen in paintings on caves walls and ceilings at Lascaux (**Figure 1**) from 22,000 years ago [4,5]. It is observed that some of these caves were without habitation therefore used only for

communication and ceremonial purposes. Most paintings are on the themes of powerful beasts and risky hunting. The paintings clearly depict the arrows stuck in animals that were shot using bow and arrows by the hunters and convey the message effectively in accordance with "a picture paints a thousand words" [6].

Historically visualization was used in medieval times as seen in some of the stained glass and other illustrations (**Figure 2**) present in old manuscripts [7].

It is seen that there is a huge amount of information is presented and it is grouped in many branches. Mary is depicted standing at the foot of the tree of virtues [7]. The tree has 7 branches i.e. prudence, fortitude, justice, temperance, faith, hope and charity. There also other character's part of this illustration i.e. Gabriel, Prudence, Fortitude and Temperance.

Another famous example of storytelling through visualization is the work done by Michael Angelo at Sistine Chapel ceiling (**Figure 3**) at Vatican City [8,9].

## Effect of visuals in a presentation

The visuals are understood up to 60000 times faster due their cognitive and emotional impact [10]. According to Burmark "... unless our words, concepts, ideas are hooked onto an image, they will go in one ear, sail through the brain, and go out the other ear.

Words are processed by our short-term memory where we can only retain about 7 bits of information (plus or minus 2). Images, on the other hand, go directly into long-term memory where they are indelibly etched."

According to Mike using the example of a simple circle (**Figure 4**) it is seen textual description requires more brain processing.

"Cognitively: Graphics increase "comprehension, recollection, and retention". Visual clues provide additional hints to understand text and derive to information creating easy to remember memory maps for the audience".

"Emotionally: Pictures give visual cues to motivate our imagination and creative thinking by stimulating our brain. This enhances emotions, attitudes and overall understanding of presentation [11]. According to Bumark visuals are better remembered as they are stored in long-term memory.

**Presentation as storytelling:** *There are always three speeches, for every one you actually gave. The one you practiced, the one you gave, and the one you wish you gave.*" – Dale Carnegie.

All presentations can be abstracted into storytelling and its subcomponents. The usual elements are the characters (stakeholders) the introduction of the problem and the solution. Within the scope from problem to the solution lie the ambience, delivery, rapport with audience and the clarity of the delivered message. In this paper we will analyze a study of 40 presenters on some of the above discussed aspects.

**Human attention span:** "Gold fish effect" is the classical definition for lack of audience attention span as it has attention of approximately 9 seconds. According to Microsoft people lose attention after 8 seconds only. In a study carried out in Canada researchers found brain activity for attention span decreased from 12 seconds pre internet era to 8 currently which is poorer than that of a gold fish [12].

In order to get keep audience attention a presenter may try to create interest by using multiple mediums such as slides and flipcharts. The rule for attention lies in making the topic interesting for the audience. Quotes, photographs and, open rhetorical questions can be combined in the storyline to keep audience interested.

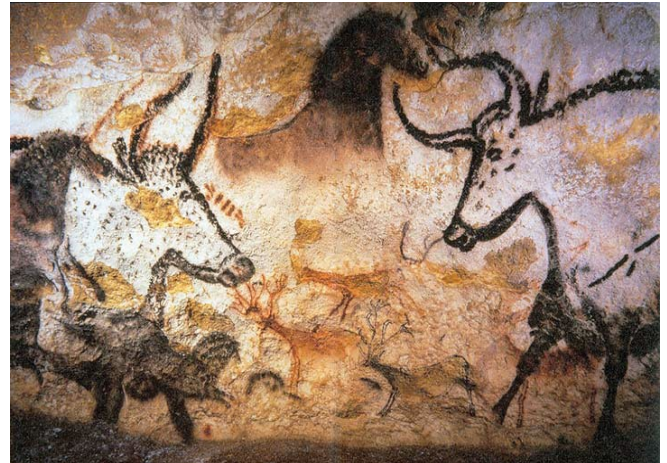
### System dynamics of presentation

A presentation system can be decomposed into three basic components; Presenter, audience and the Presentation tools (**Figure 5**).

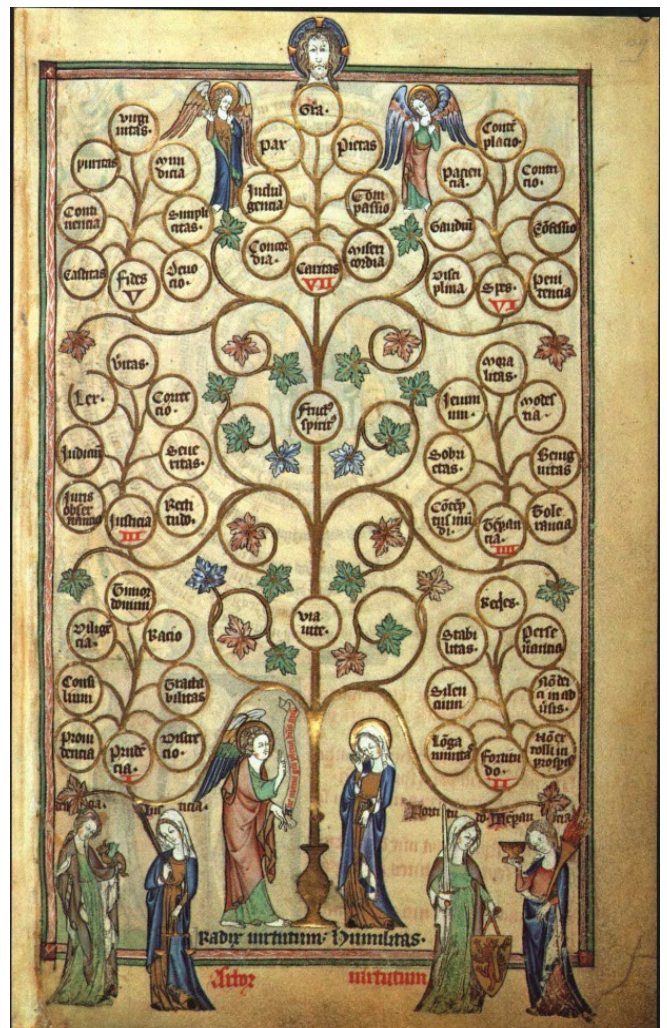
**Presenter:** The successful presenter is able to create live characters in audiences mind. They are also able to motivate audience for a change [13].

**Visualization tools:** There popular tools used in making in making audio visual presentations. These help in delivering a story to the audience and therefore a good presentation should follow the thumb rules of a good story line. Every storyline has three major aspects of characters, problem and solution. If there is ambiguity in any of these the presentation is likely to miss its intended

purpose. The visuals should be simple consistent and not create distraction. Each slide should focus on few ideas with a maximum of five bullet points.



**Figure 1** French Cave Painting of Hunting 30000 BCE.



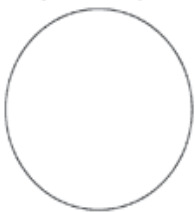
**Figure 2** Annunciation to Mary (1400AD).





**Figure 3** Capella Sistina Ceiling.

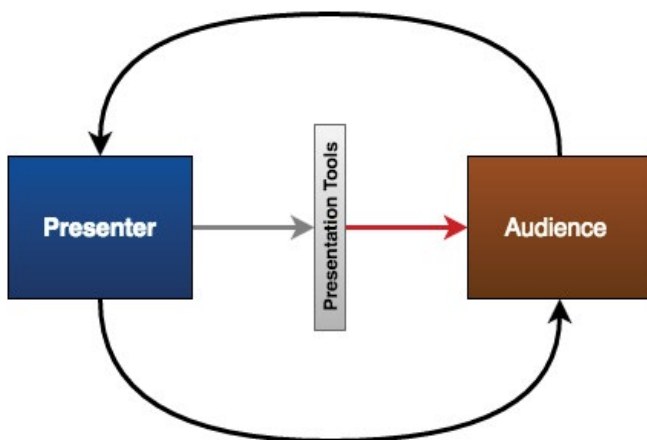
#### Graphic Description



#### Textual Description

a curved line with every point equal distance from the center

**Figure 4** Circle graphic and text description.



**Figure 5** System dynamics of a presentation.

**Audience:** Presenters who are able to identify what the audience wants make effective presentations. The presenter should focus on audience and not the presentation.

### Methods of enhancing a presentation

We propose a framework for making effective presentations using combination of environmental factors, the problem and its solution (Figure 6).

The environmental factors are the font selection, colour schema, design, time to deliver, animation and audio visual content. The identification of problem and solution factors are interaction with audience, making eye contact, incremental build up, summary to recap and the QA session.

The general rule of making presentations is, only deliver what you would want to see yourself.

## Identification of Problem and Its Solution

### Interaction

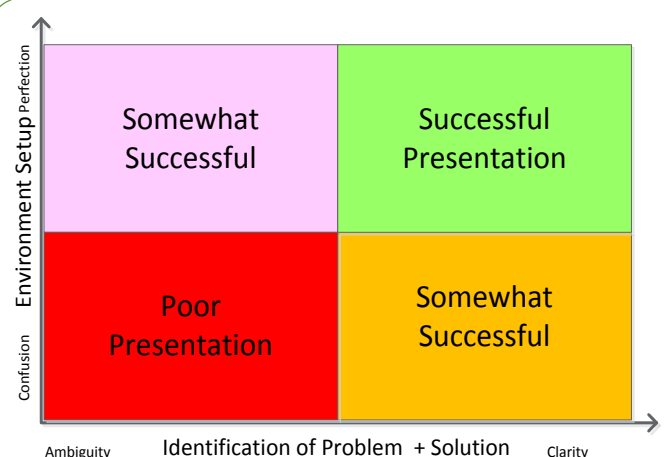
All presentations are made with the intention of making impact on its stakeholders. As in any good storyline when the target audience is able to identify themselves with the problem there is a better reception of the conveyed idea through this emotional interaction. Good presenters also put a few unbiased questions to interact with its audience. These questions are usually framed in a view to make viewers express their viewpoint and should be posed around the beginning or middle of presentation to build a rapport and to create an ambience that rapport is established with the audience by keeping the conveyed message as concise, comprehensive and simple to understand as possible. The problem should be presented in such a way that they audience is part of it. A key success factor in any story telling is the ability to connect with the audience at the level "I want you to feel what I feel". This requires belief of the presenter in their presentation as being honest in making it easy to connect to the audience. Once the audience is part of presentation they keep alert and do not lose interest. In order to achieve these objectives presenters also use strong imagery (Figure 7) and videos.

### Make eye contact with audience

According to a French proverb "The eyes are the mirror of the soul" Cicero (106-43 B.C.). Eye contact is one of the ways to form relationship with the audience. With eye contact they feel observed and believe in what is being presented. Eye contact also conveys the presenter's sincerity, honesty and confidence. Some presenters are nervous in making eye contacts. They can either make contact with their friends in audience or look towards the last wall of the room to avoid nervousness. They can also converse with an imaginary friend with whom they are comfortable and do not feel nervous.

### Present content incrementally

The presenter should follow a top down approach in his delivery. Start at the very high level view of the story and then move down



**Figure 6** Problem and environmental relationship in a presentation.

into the finer details. The presentation should not be overtly detailed yet the presenter should have the detailed knowledge. The presentation should build upon the previous slides and discussion (**Figure 8**). The end slides should wrap the storyline.

In introduction presenter discusses the problem statement and the characters and his intentions. The content is the main arguments around their story and proposed solution. Conclusion puts a wrapper over the solution, provides a summary and then further clarifies audience's questions and doubts.

### Keeping continuity and Interlinking of content

According to a web definition continuity is the unbroken and consistent existence or operation of something over a period of time; A state of stability and the absence of disruption. The delivered story line being delivered should be interlinked so the audience does not lose their viewpoint. The presenter should ensure there is continuity and linkage of the content. The last slide should be clear and summarize the main message.

### Question answer session

Presenter must be aware on all aspects of the topic and be ready to answer any questions asked by the audience.

**Skipping slides:** If a presentation exceeds allocated time then slides with repetitive information or a few unimportant bullet points can be avoided.

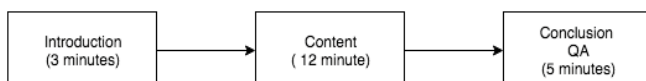
**Practice:** A presenter should practice the presentation for timing and getting familiarized with the content so slides are best not read out. Help can had from other members.

### Environmental factors of presenting

**Color schema:** Color scheme is part of environment that forms



**Figure 7** Example moving image on war.



**Figure 8** Timelines for presenting content.

part of the presentation delivery. The usual practice is to have high contrast scheme of dark blues and greens in the background with black. All color should be stable and free from flicker. Three or less color in a slide is less distracting.

**Time keeping:** The most effective storytelling and presentations occur in maximum time of 20 minutes. The 20 minutes is the upper limit of casual human adults attention span and this includes the QA time [14,15].

**Number of slides:** Using a time frame envelope of 20 min the slide number should be 15 or fewer.

**Font selection:** Presentation should be easily readable in most lighting and contrast situations. Simple sans serif fonts are easier to read however there is no distinct difference in 24 point or higher font sizes. Fonts such as Comic Sans can be used to create special ambience in some presentations by giving hand written effect. Decorative borders and ornaments are distracting and best avoided unless the topic demands so.

**Use of bullet points:** Bullet points cannot be avoided in any presentation. Bullet points can be created using semantic words or strong phrases. They can be combined with visuals that create the relationship with the implied meaning and create memory space amongst the audience.

**Animation:** Animations are both a love and hate relationship as there are too many too many choices. Overindulging in animation removes the focus and breaks the flow. If a presenter must decide on using then not more than three transitions per slide is the upper limit. Overtly complicated animations in text are distractive and add noise. If there is a loop in any animation it should stop at three replays as it suppresses the signal

**Video:** Any video that forms part of the presentation should be towards end unless part of discussion. Video length of more than 2 minutes is excessive. Some videos in student presentation may not be considered as original work if copied from YouTube. Loops are best avoided.

**Illustration and graphics:** As discussed earlier a picture is worth a thousand words. However overtly complicated illustrations defeat the intended purpose (**Figure 9**).

### Making virtual and online presentations

Virtual presentation is one of the presentation methods to present and transfer knowledge online. When making online presentations ensure that the slides have enough information. As there is no one to one interaction, presenter needs to be able to change voice according to the situation and ensure that the slides contain more diagrams/graphics. The presenter needs to check that the microphone and video is working well and all the audience can hear the voice. If the presentation is not live, presenter need to make sure that the spoken language is clear. Presenter need to practice the script before recording and make sure that there is silence second before and after presentation.

### Pitfalls to avoid

Handout end up being read during the actual presentation

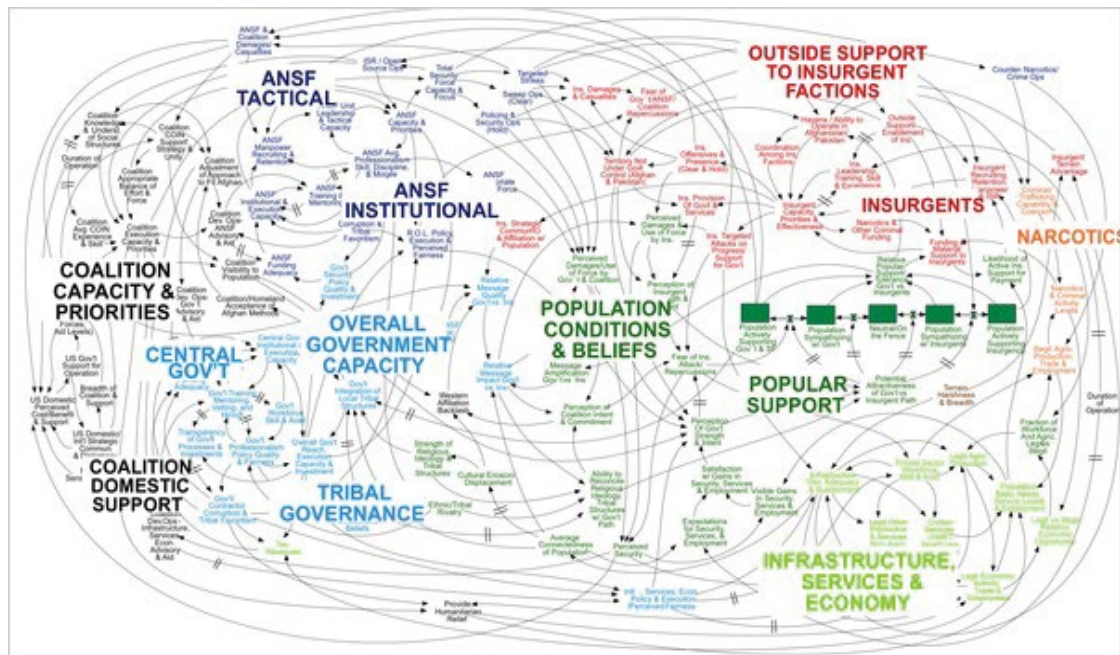


Figure 9 We found the culprit and it is Power Point.

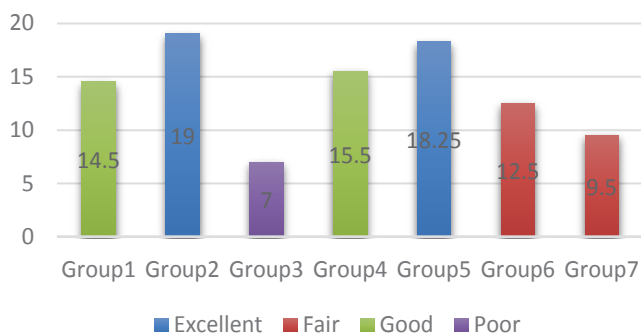


Figure 10 Groups' Assessment and Grades.

therefore the audience lose interest. Any animation that is no stop is distracting. Audience should be at ease and not feel intimidated. Avoid uhs, ahs, I think, not prepared, lack of time as all these goes against the presenter. Any auto progress also creates a situation where the presentation needs to be paused due to any reason. Any detailed descriptions are not intended in presentations and maybe be handed after presentation as further reading. Any repeated content also loses audience interest.

## Methodology

Primary research was conducted using data collected from a sample of presentations made by Undergraduate E-Commerce Students. These presentations were based on business-models and HTML web designing. The students were further divided into 7 groups of (5-6) students out of a total of 40. Marks from these seven groups of students were used in the case study. A stratified complex sampling method has been applied

in this case-study [16]. The groups were evaluated bases on

presentation criteria such as content, use of media and graphic, organization of the presentation, time spent to deliver the topic, voice modulation and subject knowledge. The evaluation was based on a scale of excellent, good, fair and poor. In detail, the groups were evaluated based on their presentations content for relevant information based on text and narration. Content included additional detailed information from further research of the topic and proper referencing. Higher marks Groups with well-designed slides, legible text, balanced use of graphics and visual effects with good proofreading scored higher grades. Students were also expected to demonstrate extensive subject matter knowledge though a QA session.

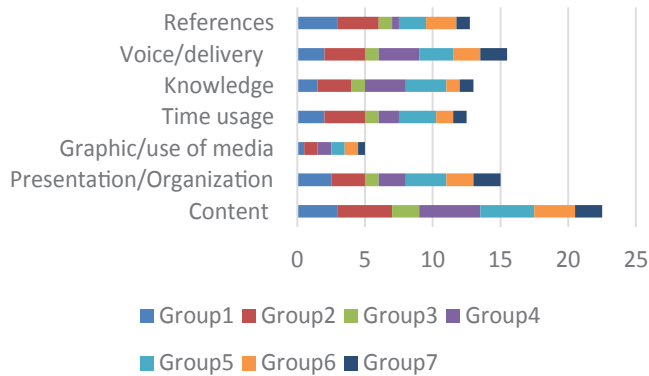
## Analyses and Discussion

The results of the previous study are provided in chart below (Figure 10). The total marks for the assessment were 20. The marking criteria were excellent grade if their marks are 17 or higher and good if their marks are within 16 to 13. A group's performance is fair when their marks are between 12 to 9 and any less than those results in poor grade.

The chart below (Figure 11) shows further detailed breakdown of the groups marks based on the assessment criteria. It is observed group 2 and 5 obtained higher grades as they full-filled the maximum assessment criteria. It is also noticed that most of the groups lost marks because of their voice (due to nervousness) was not clear, lack of deep subject knowledge or lack of practice.

Results based on the proposed framework: The framework was used in plotting the students assessment based on environmental factor vs. identification of problems and solution clarity. The X axis is based on environmental factors scale for which ranges from ambiguity to clarity. The Y axis is plotted from scale of



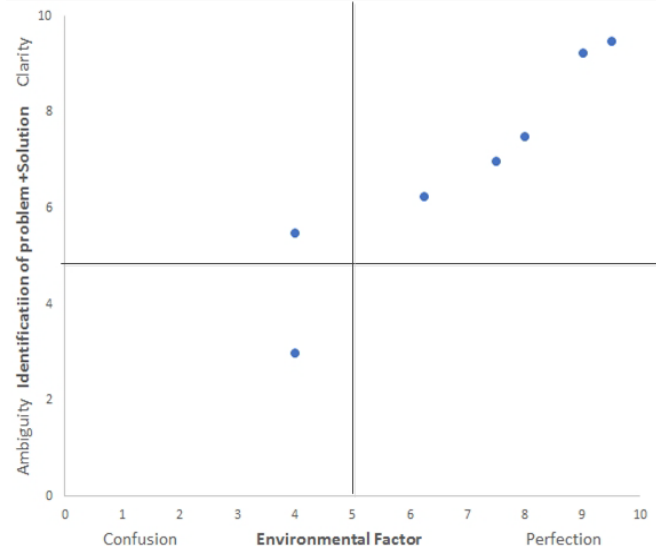


**Figure 11** Detailed breakdown of Groups' Assessment.

confusion to perfection. The evaluation is based on a subset of criteria discussed in earlier section. The groups who achieved (4,3) means they made poor presentation (**Figure 12**). Groups who achieved (9, 9.25) delivered successful presentations. The groups in between provided partially successful presentations where they were recommended to improve further.

## Conclusion

Audio visual presentations are very subjective as any other story telling. The system dynamics of presenter audience and the tools used have many variables. The criteria suggested in this paper provide scientific basis for making consistent and effective presentations. As a presentation moves from ambiguity to clarity



**Figure 12** Results based on the proposed framework.

in problem identification and confusion to perfection on the environmental factors it becomes more successful. Audio Visual presentations are mostly intended for high level discussions as some macro and micro details may be missed therefore one size fits all approach may be avoided for certain purposes [2]. Some of the criteria discussed in this paper can also be adopted to evaluate effectiveness of posters and other print media.

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