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Semantic Interference Effects of Text and Images in Stories Presented on Web

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Semantic Interference Effects of Text and Images in Stories Presented on Web

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Abstract: Our work aims to apply the research over semantic interference effects between words (text) and images in the field of web presentation. There is a lot of effort put into constructing web pages for articles such as stories and news pages. The way they are presented has a tremendous impact on how the user perceives and comprehends the content. A major issue that occupies most of the designers’ attention in building such pages is choosing appropriate images for the content. The focus of our work is to formulate few general guidelines to help a designer to handle this task efficiently. We have conducted an experiment to study how images effect the presentation. In particular, as this pertains to presentation of data on web, our experiment aims to elucidate the effect of images in articles on perception of content in the text and vice versa. For example, the presence of image in an article influences the subject in a way he/she selects the parts of text to be or not to be read, which in a way influences the overall time spent by the subject on the article. Images also affect the way subjects memorize items from an article. The domination of source, whether it is image or text content, is also discussed when they convey contradicting information.

Keywords: Semantic Interference Effects, Text and Images, Story Reading, Text Comprehension, Web Presentation

Physical Media vs. Electronic Media

In today’s world, electronic media is taking over the traditional printing media. In this realm of times where more and more people started to prefer online sources as alternatives to their physical counter parts, care should be taken so that the way of presentation of such reading material on the web, should enable them to take advantage of set of extra features to better comprehend the material they read. As the cost of publishing online is almost nothing, the space is no more a concern for publishers. So, one way to help the comprehension of the material that is read is to add appropriate images. The questions that arise are: How does the image help the reader in comprehension? What are the side effects of it? Not all the readers perceive the images the same way. What are those different results when the image presented is perceived in different ways by readers?

We started with a set of narrowed down questions that we tried to address in this work. Our study essentially investigates the mutual semantic effect of text and images.
We studied the way readers comprehend the text in three different cases. The first case simply consists of just the text and no image. The second case is where the text and image are seemingly related, but provide different information, which may/may not be contradicting. For example, in one of those stories, the story says, half-a-dozen frogs, while the picture shows four frogs. In another story, the story conveys the ethnicity of people involved to be Christian, while the picture shows it to be Hindu. In any case, proper care is taken such that image provided is relevant but carries different information to that of text. The third case presents a seemingly totally irrelevant image with the text.

**Semantic Interference Effects**

There are several published results in studying picture-word interferences. Studies like those carried out by Carmazza and Costa (2000, 2001) confirm the existence of such effects in perception of image in the presence of distracter words and investigate those effects in a sophisticated manner. Moving to a web scenario, we could find similar effects in comprehending stories which are presented using both textual and image forms. Markus and Jeffrey (2003) investigations include the timing aspect of these effects apart from other important contributions. They build on a hypothesis that semantically related distracter word would cause more delay in picture-naming process than the unrelated ones. All this work shows that the way we perceive image is affected by the text we read with it. We would like to test these effects in reading stories on the web.

Before we actually go into the details of the experiment, we will present our hypotheses, and supporting arguments.

**Hypothesis and Discussion**

*If image is relevant to the text in the story, it must increase the time spent on the article.*

In reading a story, the readers typically do not skip any content irrespective of whether they are supplemented by images or not. So, adding an image would only increase the time spent on the article. Because the image is add-on information that have to be looked at, if at all the readers pay attention to it.

*Irrelevant images interrupt the reading and increases the time spent in reading the story very badly*

In addition to previous argument presented for the first point, irrelevant images demand more time if the reader tries to fit the image in the context of the text being read.

*In case of ambiguity in the information provided, due to differences in text and image, as in our case two, in stories, reader trusts text rather than images.*

If the text presented is by itself unambiguous, the readers, by the time they have read it, will have the complete plot, theme and event flow of story in their mind. So, even if the image conveys different information that does not fit into plot, the reader discards it, as the image itself, cannot have the complete information of story in it. Here when we are considering an
image, we are doing so only in the cases where the images are used as supplement sources. We are not considering the cases where the story is told by pictures, like cartoons.

*Readers cannot remember vivid details of the story, but for images.*

By vivid details, we mean small details that may not be salient. For example, in the first story, it can be: what is the terrain the frogs are walking when one of them fell into a pit? In the story, it is mentioned that they are passing through some woods. But these details are not really necessary to get the essence of the story. They just play a role in building some ambience around the plot. Such details when presented in image are quickly recalled later.

We will now go through the details of the experiment setup and then present the results and discuss their significance in the design process.

**Experiment Setup**

**Subjects**

Forty students of International Institute of Information Technology-Hyderabad - thirty Undergraduate and ten Post Doctoral and Masters Degree students, participated in the experiment. Students are from across nine states of India. All of them are fluent in English and are proved good at comprehension of English text through various state board examinations. It is made sure that the medium of communication and presentation of stories is common and there is no difficulty with understanding the content.

**Stimuli**

Four stories were chosen for the study and two sets were created from them in the following manner.

Stories chosen: Frogs, Miser, Blacksmith and Angry kid.

Set one:

1. Frogs with relevant image
2. Miser without image
3. Blacksmith with irrelevant image
4. Angry kid without image

Set two:

1. Frogs without image
2. Miser with relevant image
3. Blacksmith with no image
4. Angry kid with irrelevant image

**Significance of Two Sets**

The way the stimuli are divided into two sets gives us two kinds of data per story. Two stories, Frogs & Miser are taken to test the effect of a relevant image in text comprehension.
Two other stories, Blacksmith & Angry kid are taken as stimuli to test the effect of irrelevant image. The stories are also chosen such that text contains some contradicting information, even with the relevant image. As we have to get two kinds of data, one with image and other without, we have split those four stories into two sets to facilitate the data collection.

Analysis

All the short stories are presented one by one till the subject reads it, he/she is given two-three minutes rest and is asked questions for those four stories. The stories used are given in Appendix A. The questions asked to collect the data were given in Appendix B.

Those questions capture the data required to test our hypothesis. Our first and second hypotheses which speak about the time spent on the article are verified against the eye tracker data we get. As we have two types of presentations for stories, one in which the presented image is relevant to the story and the other in which it is irrelevant, we get eye tracker data for both. Our third hypothesis which talks about the source domination in case of ambiguity is verified against the answers they provide for questions which particularly aim at contradictory data. For example, in the Frog story, if we asked them the number of frogs, it’s likely that they say it four instead of six because, the information available in image might inhibit the information from the text. And our last hypothesis is tested against answers to the questions which aim at minute details. For example, in angry kid story, the question asking for the number of nails dug is one such example. So, the answers to those questions could give us an overview of how the user comprehends the story. And it offers us a chance to delve into how image effects the perception of text and vice versa.

Procedure

Participants were placed in a comfortable chair in front of a Dell 17 inches LCD computer screen placed approximately 45 centimetres away from their face. The eye tracker was calibrated to the participant’s eye movements. Then they were presented with the set of instructions on the screen. When they were ready, they pressed a key and the experiment started. Each stimulus was shown to the participants until they had finished reading, at the end of which they had to answer few questions related to story.

While the participants were viewing the image, their eye movement was recorded using the Eye link system from SR research, which sampled eye position at 60 Hz. This system allowed the participants to move their head and body posture naturally and freely without needing recalibration. We used Data viewer software to display the stimuli.

Results and Discussion

We will go through the results one by one and verify them against our initial hypotheses. Along with the discussions, we will present few general guidelines to web designers which can help them choose appropriately related images to the content of the stories. Our first result follows from the following figure. Figure 1 – Stories with relevant picture, in effect tells us that when the image is related to the text, 76% of the participants are
18% of them said they did not observe the image at all, and from their answers it is found that they really have not. This supports our hypothesis that images might not play a vital role in comprehension of text in the story. Although majority of subjects are influenced, the existence of this group suggests that the influence might actually be not so vital. And there is another group, 6% of the subjects, which said the image did not attract them as much as the text in the story did and they were also verified to be true. Although 41% of the subjects were verified false in saying that their reading was not influenced by the image, still it carries an important message that, consciously, they were not paying much attention to the image part. So, what we finally could derive from these statistics is that, nearly 65% (41 + 18 + 6) were not consciously paying attention to the image. While 35% of them were.

We will move on to the second interesting result. The statistics are presented in Figure 2 – stories with irrelevant image. 53% of them straight away said they did not notice the image and they did not remember seeing any. This emphasises our hypothesis which says images does not play as much as the role of text in stories. This also proves that readers only pay very little attention towards the images, in stories. If that had not been the case, we should have seen more people reporting that the image in irrelevant. We only have seen 20% of the subjects actually doing so.
What fascinates us more is that 27% of the people related it to the story. Most of them have done so, metaphorically. And these people actually took longer time when compared to others. Their eye tracker data shows that they have spent considerable amount of time looking at the image and trying to bring a relation between the text and the image. This again emphasises and supports our hypothesis that irrelevant images associated with text in stories increase the total time spent in reading it. Eye tracker data of the 53% subjects barely have a fixation point on the image. Other 20% were having few fixations which were longer than those of 53% subjects, but not as long as those of 27% subjects. This also supports our hypothesis that image stands as add-on information source to text which increases the duration of time spent on the story.

In third result, we will look at the source of trust or dominating source in both the cases, when the image is relevant to text and when it is not. In Figure 3, we see that images stand as dominating source when they are related to the text. This can be explained by the following argument. Once the images are seen as contextual to the story, the reader trusts this source of information. As images are better remembered than text (X Suo et al, 2005), the information in images thus dominates the information in the text.
Now let us look at the other part where the image is irrelevant to the text in the story. In Figure 4, it is clear that barely readers took the help of image in answering questions which targeted ambiguous data.

![Figure 4: Dominating Source for Stories with Irrelevant Image](image)

Now this emphasises the role of text in its influence over the reader whether or not to consider the image to be a source of information in that page. Apart from the plot of the story, there are few characteristics which could be analysed to find out how visual a particular piece of text is. (Barnard et al, 2005 & 2006). Though they are primarily intended for image annotation over web, such tools can be made use of in determining the images to be put in stories, which can act as a suggestive mechanism.

![Figure 5: Recall Patterns in the Presence of an Image](image)
The final result speaks about the recall patterns in the presence of image and in its absence. Our hypothesis is that readers will not be able to remember vivid details, but for images. But the results are not so supportive of this hypothesis. Looking at Figure 5 and Figure 6, we can see that there is no much influence of images in remembering the details. This can be explained by the following argument. Reading in general, stimulates mental images (Sadoski et al. 1990 & Sadoski 1998). And stories, in particular contain a lot of content which is absorbing and interesting, which will make readers imagine the visuals of the text content. These themselves save the purpose of images, though in the minds of readers. So, the stimuli which we present in the form of an image along with the text, may not make a big difference in the recall patterns in the readers. So, essentially what this says is, the designer may not focus primarily on images to run the plot with vivid details. But it’s important that there is a stimuli in the text that can engage reader in imagination so that those details are not forgotten soon.

**Conclusions**

We will once go through some of the conclusions we drew from the results. Majority of the readers does not pay attention to images consciously, but still if the image is relevant to the content, then majority of the readers will be influenced by the information in the image. The readers pay very little attention to images, in reading stories. Images might not be as useful as they are thought to be, in comprehension of the story, but yet, they stand as dominating sources of information as the content in image is remembered longer than text content. The role of text in inculcating attention towards image, in the story, is vital and needs special attention. As reading stories engages readers in imagination which is more vivid than the images we present, many a time, the best way to tell a story is to leave the visualization part to the reader. What a designer or story teller could possibly do is to catalyze this process using appropriate lingo, instead of trying it with images. This way we could expect the recall patterns to be better, too.
Future Work

News articles are common electronic media we all are familiar with and use in day-to-day life. We would like to investigate the role of images in designing news articles. Interestingly, images, contrary to the case of stories, play a vital role in a news article. They not only help us to filter the unwanted news, but also play a crucial role in validating the authenticity of the news published. Hence, we would like to consider the news articles for further study.

References


Appendix A

Frogs

A group of dark frogs were traveling through dry woods, and two of them fell into a deep pit. When other four saw how deep the pit was, they told those two frogs that they were as good as dead. The two frogs ignored the comments and tried to jump up out of the pit with all their might. The other frogs kept telling them to stop, that they were as good as dead. Finally, one of the frogs took heed to what the other frogs were saying and gave up. He fell down and died.

The other frog continued to jump as hard as he could. Once again, the crowd of frogs yelled at him to stop the pain and just die. He jumped even harder and finally made it out. When he got out, the other frogs said, “Did you not hear us?” The frog explained to them that he was deaf. He thought they were encouraging him the entire time.

This story teaches two lessons:

• There is power of life and death in the tongue. An encouraging word to someone who is down can lift them up and help them make it through the day.
• A destructive word to someone who is down can be what it takes to kill them.
Be careful of what you say. Speak life to those who cross your path. The power of words! It is sometimes hard to understand that an encouraging word can go such a long way. Anyone can speak words that tend to rob another of the spirit to continue in difficult times. Special is the individual who will take the time to encourage another.

Relevant Image Used with this Story

**Miser**

There was a man who had worked all of his life and had saved all of his money. He was a real miser when it came to his money. He loved money more than just about anything, and just before he died, he said to his wife, “Now listen, when I die, I want you to take all my money and place it in the casket with me. I want to take my money to the afterlife.”

So he got his wife to promise him with all her heart that when he died, she would put all the money in the casket with him.

Well, one day he died. He was stretched out in the casket; the wife was sitting there in black next to her closest friend. When they finished the ceremony, just before the undertakers got ready to close the casket, the wife said “Wait just a minute!” she had a shoe box with her; she came over with the box and placed it in the casket.

Then the undertakers locked the casket down and rolled it away.

Her friend said, “I hope you weren’t crazy enough to put all that money in the casket.”

She said, “Yes, I promised. I’m a faithful religious woman, I can’t lie. I promised him that I was going to put that money in that casket with him.”

“You mean to tell me you put every cent of his money in the casket with him?”

“I sure did,” said the wife. “I got it all together, put it into my account and I wrote him a check.”
Blacksmith

There was a blacksmith once who complained: “I am not well, and my work is too warm. I want to be a stone on the mountain. There it must be cool, for the wind blows and the trees give a shade.” A wise man who had power over all things replied: “Go you, be a stone.” And he was a stone, high up on the mountain-side. It happened that a stone-cutter came that way for a stone, and when he saw the one that had been the blacksmith, he knew that it was what he sought, and he began to cut it. The stone cried out: “This hurts! I no longer want to be a stone. A stone-cutter I want to be. That would be pleasant.” The wise man, humoring him, said, “Be a cutter.” Thus he became a stone-cutter, and as he went seeking suitable stone, he grew tired, and his feet were sore. He whimpered, “I no longer want to cut stone. I would be the sun; that would be pleasant.” The wise man commanded, “Be the sun.” And he was the sun. But the sun was warmer than the blacksmith, than a stone, than a stone-cutter, and he complained, “I do not like this. I would be the moon. It looks cool.” The wise man spoke yet again, “Be the moon.” And he was the moon. “This is warmer than being the sun,” murmured he, “for the light from the sun shines on me ever. I do not want to be the moon. I would be a smith again. That, verily, is the best life.” But the wise man replied, “I am weary of your changing. You wanted to be the moon; the moon you are, and it you will remain.”

And in high heaven, lives he to this day.
Angry Kid

There once was a little boy who had a bad temper. His father gave him a bag of nails and told him that every time he lost his temper, he must hammer a nail into the back of the fence.

The first day, the boy had driven 37 nails into the fence. Over the next few weeks, as he learned to control his anger, the number of nails hammered daily gradually dwindled down. He discovered it was easier to hold his temper than to drive those nails into the fence.

Finally the day came when the boy didn’t lose his temper at all. He told his father about it and the father suggested that the boy now pull out one nail for each day that he was able to hold his temper. The days passed and the boy was finally able to tell his father that all the nails were gone.

The father took his son by the hand and led him to the fence. He said, “You have done well, my son, but look at the holes in the fence. The fence will never be the same. When you say things in anger, they leave a scar just like this one. You can put a knife in a man and draw it out. It won’t matter how many times you say I’m sorry the wound is still there. A verbal wound is as bad as a physical one.”
Appendix B

Common Questions Asked for Set One and Set Two

Frog Story
1. What color are the frogs?
2. How many were there?
3. Where are the frogs walking when they fell?
4. What did the other frogs do when two of them fell?

Miser Story
1. What’s the ethnicity of the people here? Hindu/Christian/Muslim?
2. Who’s the woman speaking to? a man/woman?
3. How do you know (for answer in second question)?

Blacksmith
1. What are the various roles played by blacksmith?
2. What life does the blacksmith want?

Angry Kid
1. How many nails has he been given and how many does the boy drive on the first day?
2. Tell the comparison/analogy that is brought out in the story?

Set One Specific Question
Frog & Blacksmith

1. How’s the picture related to the story and do you think it influenced your answers?

Set Two Specific Question
Miser & Angry kid

1. How’s the picture related to the story and do you think it influenced your answers?

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