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Empirical Study of Information Design: Four Experiments

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Empirical Study of Information Design: Four Experiments

Noël T. Alton

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

Master of Arts

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ABSTRACT

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Current design theory sets out many rules and guidelines for designers, but good design is still difficult to replicate. Often the design principles found in the manuals are misapplied, resulting in designs that (1) do not fulfill their purpose and (2) disrupt the clarity of information.

This thesis will review and provide experimental data supporting a model of visual form/visual purpose connections based on the semiotic of C.S. Peirce. This model was first used by Amare and Manning (2005, 2006, 2007, 2008, 2009) to evaluate and explain both effective and ineffective visual information design. This thesis will extend their approach, reporting on the results of four experiments to test the aesthetic appeal and information retention from various visual designs.

The four experiments presented in this thesis show that viewer's ability to recall information does not coincide with designs that they find the most visually stimulating or visually pleasing. High indicative contrasts allow for higher retention rate, but those contrasts do not necessarily conform to viewer's aesthetic preferences. Low indicative contrast options have a lower retention rate, but are preferred aesthetically by viewers. Peircean analysis accounts for this disconnect between usability and preference and can help designers find the balance that is needed between these competing purposes in visual information design.

Keywords: Peirce; visual design; empirical studies; design theory

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Table of Contents

Chapter 1 - Introduction.....	1
Introduction to Design	2
Peirce’s Categories in Language and Information Analysis.....	6
The Peircean Categories as Visual Elements.....	7
Firstness	7
Secondness.....	7
Thirdness.....	8
Experiment Overview	12
Results Overview	12
Chapter 2 – Current Design Theory.....	14
Color	15
Images.....	17
Charts and Graphs.....	18
Text.....	19
Chapter 3 - Problems with Current Design Theory	21
Mixed Recommendation.....	21
Chapter 4 – Peirce and Design Theory	26
Peirce and Design Theory.....	30
Decorative Icon – 1-1-1	30
Image Icons – 1-1-2	32
Signaling Indices – 1-2-2	34
Action Indices – 2-2-2	35
Informative Icons – 1-1-3	37
Reference Indices 1-2-3	39
Ritual Indices – 2-2-3.....	40
Symbols – 1-3-3, 2-3-3, & 3-3-3	41
Application to Research.....	43
Chapter 5 – Menu Design Experiment.....	45
Methodology.....	47
Participants.....	47
Questionnaire	47

Procedure	48
Results.....	49
Analysis.....	51
Chapter 6 – Diagram Design Experiment.....	54
Methodology.....	56
Participants.....	56
Survey	57
Procedure	57
Results.....	58
Analysis.....	60
Chapter 7 – Bar Charts Experiment.....	63
Methodology.....	66
Participants.....	66
Survey	66
Procedure	68
Follow Up Survey.....	68
Participants.....	68
Survey	69
Results.....	69
Analysis.....	72
Chapter 8– PowerPoint Experiment.....	75
Methodology.....	79
Participants.....	80
Survey	80
Procedure	81
Results.....	81
Analysis.....	83
Chapter 9 – Results	87
Menu Experiment.....	87
Diagram Experiment.....	90
Bar Charts Experiment.....	91
PowerPoint Experiment	93
Chapter 10 – Conclusion.....	96

Experiment Review.....	97
Experiment Limitations	98
Implications.....	99
Future Work	100
References.....	103
Appendix A – Informed Consent.....	110
Appendix B – Menu Questionnaire	112
Appendix C – Diagrams Questionnaire	115
Appendix D – Bar Charts Questionnaire	117
Follow Up	121
Appendix E – PowerPoint Questionnaire	125

List of Figures

Figure 1.1	Jarring colors create disunity and confusion	3
Figure 1.2	Simple themes create visual unity	4
Figure 1.3	Lack of variation in indicative images creates confusion	5
Figure 1.4	Text walls are difficult for viewers to process	6
Figure 1.5	Peircean structure of a car braking for a red light	9
Figure 1.6	Peircean categories for basic design principles	11
Figure 2.1	Images that are irrelevant to the visual confuse viewers	17
Figure 3.1	Blind rule following can lead to bad design	22
Figure 3.2	Adding visual interest can distract from the information	24
Figure 3.3	Creating lists can make information more accessible	25
Figure 4.1	Peircean Expansion from three to six	27
Figure 4.2	Ten-Place Peircean system	28
Figure 4.3	Ten-Place Peircean Design system	31
Figure 4.4	Decorative Icons	31
Figure 4.5	Disrupted unity of message	33
Figure 4.6	Image Icons	33
Figure 4.7	Signaling Indices	35
Figure 4.8	Action Indices	36
Figure 4.9	Leading edge of perception	37
Figure 4.10	Informative Icons	38
Figure 4.11	Reference Indices	39
Figure 4.12	Ritual Indices	40
Figure 4.13	Shopping Cart Ritual sequence	41
Figure 4.14	Word-Symbols	42
Figure 4.15	Sentence-Symbols	42
Figure 4.16	Whole-Text-Symbols	42
Figure 5.1	Menu 1 and Menu 2	45
Figure 5.2	Menu 3 and Menu 4	46
Figure 5.3	Menu 5 and Menu 6	46
Figure 5.4	Menu 7 and Menu 8	47
Figure 5.5	Likert Scale	48
Figure 5.6	Effects of added design features on overall Menu preference	52
Figure 6.1	Bug's Life 1	55
Figure 6.2	Bug's Life 2	55

Figure 6.3	Bug's Life 3	56
Figure 6.4	Bug's Life 4	56
Figure 6.5	Overall visual preference in terms of increased contrasts/color/imagery	61
Figure 6.6	Answer accuracy in terms of increased contrasts/color/imagery	62
Figure 7.1	Bar Chart 1 and Bar Chart 2	64
Figure 7.2	Bar Chart 3 and Bar Chart 4	64
Figure 7.3	Bar Chart 5 and Bar Chart 6	65
Figure 7.4	Bar Chart 7 and Bar Chart 8	65
Figure 7.5	Table 1	66
Figure 7.6	Overall preference with reference to added contrasts/color/imagery	72
Figure 7.7	Answer accuracy in reference to added color	73
Figure 8.1	Text Option 1	76
Figure 8.2	Text Option 2	76
Figure 8.3	Text Option 3	77
Figure 8.4	Text Option 4	77
Figure 8.5	PowerPoint 1 and PowerPoint 2	78
Figure 8.6	PowerPoint 3 and PowerPoint 4	79
Figure 8.7	PowerPoint 5 and PowerPoint 6	79
Figure 8.8	Text Option Answer Accuracy	84
Figure 8.9	Answer accuracy in reference to contrasts, color, and imagery	85
Figure 8.10	Overall Preference of PowerPoint Design	86
Figure 9.1	Preferred Menus – Menus 2, 4, & 6	87
Figure 9.2	Preferred menu in reference to Peircean Triangle	88
Figure 9.3	Menus 7 and 8	89
Figure 9.4	Menus 3 and 5	89
Figure 9.5	Diagrams based on Peircean Analysis	90
Figure 9.6	Bar Chart 3 and Bar Chart 2	91
Figure 9.7	Bar Charts vs. Tables on Peircean Triangle	92
Figure 9.8	Commissions Table	92
Figure 9.9	Text-Only Options based on Peircean Analysis	93
Figure 9.10	PowerPoint slides based on Peircean Analysis	95
Figure 9.11	PowerPoint 1, PowerPoint 2, PowerPoint 4	95

List of Tables

Table 2.1	Summary of current design recommendations for major design elements	14
Table 4.1	Jessica Young's Table of Plot Types	29
Table 5.1	Total Points per Menu	49
Table 5.2	Likert Scale rankings for each Menu	50
Table 5.3	Menu Comparison Totals	50
Table 6.1	Total Points per Diagram	58
Table 6.2	Likert Scale rankings for each Diagram	59
Table 6.3	Diagram Usefulness rankings	59
Table 6.4	Percentage of correct answers in information recall	60
Table 7.1	Total Points per Chart	69
Table 7.2	Likert Scale rankings for each Chart	70
Table 7.3	Percentage of correct answers in information recall	70
Table 7.4	Comparison of 2D bar charts, bright colors and image	71
Table 7.5	Comparison of muted color schemes, 2D and 3D	71
Table 7.6	Comparison of 3D options, black and white and image	71
Table 7.7	Comparison of B&W 2D to Table	72
Table 8.1	Total Points per PowerPoint	82
Table 8.2	Likert Scale rankings for each PowerPoint	82
Table 8.3	Percentage of correct answers in information recall	83

Chapter 1 - Introduction

Good design is easy to recognize, but hard to replicate. The problem comes when a designer needs to find the optimal point of balance between various visual elements and purposes, e.g. color that is decorative as opposed to color that is meant to specifically draw the eye to key points, as opposed to other visual elements such as images, clipart, boxes, and borders, and also the visual arrangement of text on the page. This optimal point between too much and too little of any given visual element is hard to deduce. It is well agreed, however, that there needs to be a balance in design. Lynch and Horton (2002) have said that visual design should balance visual sensation and information. This ideal is echoed by Lawrence and Tavakol (2007). Farkas and Farkas (2002) also recommend that graphics and animations be limited to grabbing attention, but they caution that overuse of these things detracts from the information being presented. The idea of balance in visual design is well-documented by design experts from all media, but what is generally lacking is a more precise specification of how that balance is achieved, where the tipping point between effective and overused color imagery is found.

This thesis will present a several specific examples of current design and talk about basic design functions in reference to the work of Charles Sanders Peirce. Then there will be a discussion on current design theory's advice to designers. Current design theory focuses on giving general advice, with few specific recommendations for actual use of design options. After current design theory is established in Chapter 2, Chapter 3 will discuss specific design problems which current theory has not effectively addressed. Next, there will be a detailed discussion of Peirce's theory of semiotics and how this can be applied to the design problems enumerated in Chapter 3. By building a design theory around Peirce's theory of semiotics, designs can be tested

to show that viewer's preference on aesthetics need to be weighed against the informative function of the design. This design theory will also help explain why viewer's preference and informative function are at odds and how to reach a balance.

This chapter will present a few specific examples of visual design. Each visual design will be critiqued in general terms. After the brief introduction to design theory and practice, there will be a discussion of C.S. Peirce's semiotic and how it can begin to relate to visual design. This section will cover an introduction to Peirce's three categories and how they interact with each other. Finally, a brief introduction to each of the experiments and their results will conclude this chapter.

Introduction to Design

Designers are told that color palettes can be used to create a feel for the design being created. Color can also draw attention to different items in the visual design field. Figure 1.1 shows that this designer chose bright colors contrasted on a dark background to create their color scheme. This sharp contrast is jarring and leaves the viewer disoriented. Text boxes are called out from the color scheme with the traditional black text on a light background. This sharp contrast does not jar the viewer, but effectively draws their attention to the information being presented.

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Use time and color as extra dimensions (to create motion or encode momentum, for example). Use the scrollbar to vary parameters in realtime, to slice through graphs, or to vary transparency. Programmed entirely in assembly language for maximum speed.

Graph functions, equations, conic sections, planes, spheres, toruses, parametric curves and surfaces, implicit

Figure 1.1 – Documents often suffer from jarring color variations, creating feelings of unrest in the viewer. (<http://www.dpgraph.com>)

Similarly, the use of the red box to advertise this page's software creates another instance where the viewer's attention is purposefully pulled to a specific item on the page. The color here is being used; again, to call out what the designer feels is most important for the viewer.

The designer for Figure 1.1 did not limit their color palette creating a chaotic feeling; however, the designer of Figure 1.2 chose to limit their color palette creating a more unified feeling. The use of a neutral black background and complimentary colors creates a balanced design that does not interfere with the viewer's ability to process the information. Each category heading is called out in orange in Figure 1.2, where Figure 1.1 used different colors for each of their text boxes. By using only one color for all headings, the designer has not sacrificed grabbing the viewer's attention, but has given the overall design aesthetic a feeling of unity.



Figure 1.2 – Documents that stick to simple themes create a feeling of unity and can more easily focus the eye on important details. (<http://www.megawraps.com/site/HTML>)

Figure 1.2 also illustrates the use of images as a means to draw attention and convey information to the viewer. In this example, the designer uses one image per food category on the menu. The images grab the viewer's attention and then convey what type of food is contained in the list, even before the viewer has to read the list heading.

Figure 1.3, below, uses the same image for all links on the page. While this may solidify market branding, it leaves the viewer unable to instantly ascertain what the link is for. Many designers use the same, or similar, images to help create a feeling of unity and parallelism, but done incorrectly will just confuse the viewer. The designer did list the links in a grid format, but it lacks any real organization beyond that; the links are not organized alphabetically or in any way that would aid the viewer in finding the proper link.



Figure 1.3 – Here images of the brand’s sugar substitute act as links to various sub-pages. Lack of variation in the images creates confusion for the viewer. (<http://justlikesugarinc.com>)

The problems illustrated above deal mostly with layout, decorations, and images.

However, designers often create problems by overusing raw text in a visual design. Figure 1.4 shows how using unorganized text can make it a challenge for the viewer to process any information. In this example, the author’s deliberately used no paragraph breaks to help organize the information. Similarly, little space between the lines creates difficulty in processing the information. Nevertheless, this thesis will report empirical results suggesting that viewers, if challenged to extract information from a wall of text, may retain information better from such a presentation than they might if the text is merely divided by phrasal headings, which may end up distracting from propositional information.

We will frame discussion in terms of C.S. Peirce's "Ten Classes of Sign" which Peirce himself represented as an inverted pyramid (Collected Papers, volume 2, paragraph 264). (I) Decorative Icons--borders, font shapes,color, etc. (II) Image Icons--photographs, realistic illustrations. (III) Signaling Indices--bullet points, arrows, flashing banners, etc. (IV) Action Indices--web links, buttons,page tabs, etc. (V) Informative Icons--diagrams, charts, graphs. (VI) Demonstrative Indices--tables, figure labels,etc. (VII) Informative Indices--figure captions, line-byline instructions, etc. (VIII) Word-symbols--nouns, verbs,adjectives, etc. (IX) Sentence-symbols--propositions, clauses, if-then statements, etc. (X) Whole-Text-Symbols--stories, sales pitches,reports, explanations, etc. The roman numerals represent Peirce's own numbering of his ten types. In this version of his ten categories, we have adapted his terminology to a modern audience and supplied key examples of each type. These key examples, as divided and classified in the Peircean system, will each be discussed in detail. We propose to develop a unified visual rhetoric based on Peirce's model which will explain how and why different rhetorical situations require different kinds of visuals, from both a practical and an ethical standpoint. Although Peirce's system seems at first rather intricate, it is based on very simple principles, the logic of which we will develop from three fundamentals. Types I, IV, and X above represent the terminal points of a large triangle. Each of these types can be described as the extreme manifestations of three basic rhetorical purposes: (First) to decorate--to create a quality of feeling in the audience--borders, font shapes, color, etc., creating an overall feel for a document. (Second) to indicate--to provoke an audience to action, locating, dividing, classifying, etc.--web links that can be clicked, action-activating buttons, page tabs that can be turned, etc. (Third) to inform--to promote in an audience further understanding of some idea--stories, sales pitches, reports, explanations, etc. Between the extremes of pure decoratives, pure indicatives and pure informatives there are a range of intermediate types. Diagrams and other kinds of technical graphics have definite aesthetic-decorative properties but they serve primary informative purposes, just as pure text does. Images likewise have strong aesthetic properties but unless carefully edited for aesthetics they serve primary indicative purposes, to represent specific things to an audience. Step-by-step instructions are in contrast a mix of strongly indicative and informative elements.

Figure 1.4 – Text walls make for difficult reading of the information. (Manning & Amare 2007)

On the other hand, if viewers are too intimidated by large, undifferentiated blocks of text, they may not read it at all. Again, notice the problem of balance: propositional information and text which can be exhausting, vs. visual breaks and resting points, which can be distracting.

Each of these figures demonstrates some of the key problems, and successes, of effective design. Even well-intentioned, highly experienced designers can create what turn out to be poor designs, and this is at least partly due to the lack of a general theory of good visual design. Along with the lack of a coherent, organizing framework for the diverse kinds of visual design advice, there is little quantitative evidence to support one design choice over another. This thesis will set out to create both an organizing framework for visual design choices as well as empirical evidence for some choices over others, based on the semiotic categories of Charles Sanders Peirce, as applied to the classification of form, effects, and goals of various visual design elements.

Peirce's Categories in Language and Information Analysis

Charles Sanders Peirce's work includes much discussion on the notion of three categories, which he claimed are pertinent to everything in the universe. Intrinsic in Peirce's

theories is the idea that all ‘phaneron’ (or phenomenon) can be discussed or classified in terms of Firstness, Secondness and Thirdness (1956, pg 74-75).

The Peircean Categories as Visual Elements

Firstness

Peirce’s category of Firstness defines the form-object connection for the visuals known as *icons*, i.e. abstract emotion-provoking forms, object-reflecting images, and proposition-asserting diagrams. All of these connect form and object by means of what Peirce defines as a ‘likeness’ or forms “which serve to convey ideas of the things they represent simply by imitating them” (CP, v. 2, p 281).

In other words, Firstness is the abstraction of imitative perceptual qualities from actual objects and those imitative qualities then can potentially represent many, many, feelings, objects, and ideas similar to the original perception. Thus, Firstness is the category of representation which is "potential via pure abstraction" (Young, 2003, p 37).

Any type of abstraction from direct perception would correspond with Peirce's idea of Firstness. Because emotions are fundamentally perceptual qualities abstracted from perceptual experience, they belong to Firstness by definition and consequently *decorative* visual design elements that primarily evoke emotion are classified in terms of Firstness. This means that they are placed toward the upper-left corner of a standard Peircean triangle, as shown in Figure 1.6 below.

Secondness

Peirce’s category of Secondness defines the form/object connection for the visuals known as indexes i.e., arrows, bullet points, blinking signs, also web links as well as tables of

information where columns physically overlap with rows. All these visual elements connect form and object "on account of their being physically connected to them" (CP vol 2, p 284). In other words we look at things that indexical visuals physically point to. Secondness is the category of existence, of fact, and the "necessity of contrast or agreement" (Young, 2003, p. 37). Any physical connection that calls attention to itself by standing in contrast, conflict, or opposition to surroundings would correspond with Peirce's idea of Secondness.

Since each action physically provokes a contrasting reaction, Secondness is seen as the category of action, and *indicative* visual design elements that fundamentally provoke action are classified in terms of Secondness. This means that they are placed toward the bottom point of a standard Peircean triangle, as shown in Figure 1.6 below.

Thirdness

Peirce's category of Thirdness defines the form/object connection for the visuals known as symbols (in the technical, Peircean sense). Words, sentences, and extended blocks of text are all symbols in the Peircean sense, and each of these, at least in writing, has a strong visual component. All symbols including written language, connect form and object by virtue of being repeated patterns, patterns "which have become associated with their meanings by usage" (CP v. 2, p 292). The idea of a repeated pattern which acquires meaning by habitual usage is the essence of Peirce's idea of Thirdness. Symbols, as repeated patterns, "mediate between objects and the concepts surrounding them" (Young, 2003, p. 38). Any asserted connection between objects (e.g. *those swans*) and concept (e.g. *are white*) is by definition a proposition of some kind, and propositions by definition can be true or false. A true proposition is in essence a proposition that can be asserted repeatedly in the face of any critical contradiction or challenge.

Visual design elements that assert propositions (object-concept connections) by virtue of embedded text OR other conventional patterns are therefore classified in terms of Thirdness. This means that they are placed toward the upper right corner of a standard Peircean triangle, as shown in Figure 1.6.

To exemplify the interplay of these categories, consider a normal day on the road. A driver comes to a red light and stops the car. This is a process that drivers go through hundreds of times. Why? When broken down in terms of Peircean theory, this scenario can show how the three categories interact. The Firstness in this situation is the red light, there is nothing inherent in that red light that makes it mean anything. A red light could be a laser pointer, the power light indicating the TV is off, or hundreds of other things encountered in a normal day. In this situation, a red light has been placed at the intersection and is an icon. The actual force applied to the brakes is the indexical reaction to the red light, or Secondness. What compels us to stop at the red light? There is a law, or Thirdness, that associates the red light with applying pressure to the car's brakes and stopping the car. The law is simply stated as "red light means stop."

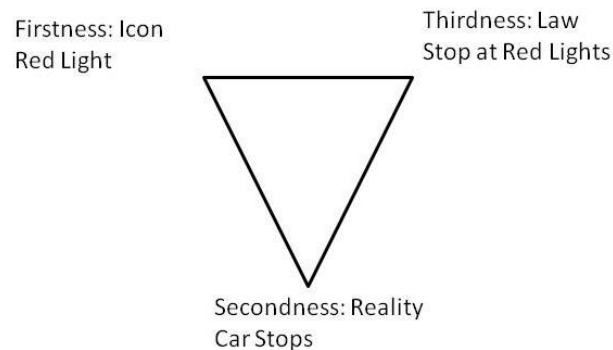


Figure 1.5 – Peircean structure of a car braking for a red light (Young, 2003, p 38)

Figure 1.5 exemplifies, in visual form, the interaction of each part of the Peircean categories.

With this basic structure in mind, a Peircean analysis of design theory can start to be formed at its most basic levels.

In recent years, there has been a resurgence of work on the basis of Peirce's theories and their application to many different disciplines. One discipline where Peirce's work has been applied fairly extensively is that of linguistics, as evidenced in Robertson's English inflectional morphemes (1994) and Gomez and Manning's X-bar analysis (1997). Jessica Young (2003) used Peircean types to categorize story types. Matthew Carmack (2000) was able to categorize technical information types through a Peircean analysis.

For the purpose of this thesis, Peirce's theory of semiotics will be applied to design which will give designers a more substantial theory that they can use as a guide when creating documents and perhaps more importantly, as a means to evaluate and revise visuals in the editing process.

Recall Figures 1.1 and 1.2. Figure 1.1 had jarring differences in the colors presented, and Figure 1.2 used a more unified color palette. The colors sole purpose on the page is to evoke *feeling* which would line up with Peircean Firstness. In Figure 1.2 images were used to call attention to different lists of food items being sold. These images were used to provoke an *action* which is part of Peircean Secondness. Finally, the last Peircean category, or Thirdness, is exemplified in Figure 1.2 through the columns of food items; each of these columns contained information or asserted *propositions* about the food being sold at this particular restaurant. With this in mind a new vocabulary can be proposed to talk about these basic design functions.

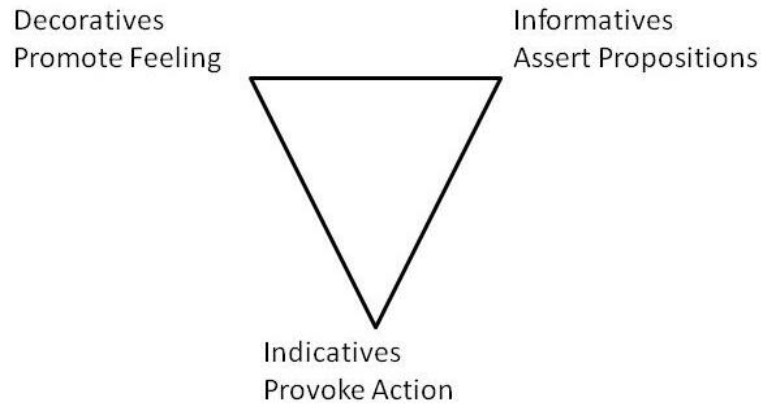


Figure 1.6 – Peircean categories for basic design principles

Design relies upon these three categories, working together, to reach some end result with the viewer.

Decoratives are used to create a certain feeling in a viewer. Advertisers rely strongly on emotions to convince the viewer that they need a product. Take for example, the DeBeers diamond commercials. These commercials use shadows of people, icons, and a single piece of jewelry to advertise. Without any words the advertisers are able to convince the viewer that they want that piece of jewelry.

Indicatives are used to draw attention to a particular item, or to create some action in relation to that item. This is best exemplified with online networking sites. These sites want to draw the viewer's attention to different newsfeed items, so the designers create separate icons to distinguish each item type. With all these competing bullet points, the viewer's attention is constantly divided between the different elements on the page, unless the viewer learns to filter the icons out.

Informatives are the actual information being presented to the viewer. This information can be presented in many different ways. Figure 1.4 used sentences only to portray the information. This lead to a problem that viewers often encounter: long bodies of text that can

become quiet dense and hard to wade through. But with simple techniques, the designer can take those labor intensive ‘text walls’ and make them easier to assimilate for the viewer.

Experiment Overview

This thesis will use a Peircean framework to evaluate four experiments that were designed to locate, empirically, the optimal balance point between various design elements. Each experiment focused on a different medium for information transmission: menus, charts, graphs, and PowerPoint slides.

Each experiment focused on different design techniques, as well as the different media mentioned above.

1. **Menus** were used to test color use as decoration and as a means to direct attention. Images were also tested for their ability to decorate and direct attention.
2. **Diagrams** were used to test the use of images, both drawn and photographic, as information bearing units. Color was used in the drawn images to test for visual enhancement preference.
3. **Graphs** were used to test color as a decoration and as a means of directing attention. Color was contrasted with images as decorations.
4. **PowerPoints** were used to test text shape as a visual element and as an information bearing method. Color and images were revisited in reference to its use as attention grabber and decoration.

Results Overview

The results of each of the experiments will show that the theoretic framework presented in this thesis will help define the difference between what viewers find aesthetically pleasing and what designs will allow viewers to retain more information. Viewers prefer simple, unified decoration over complex decoration that has great contrasts. However, in terms of memory recall the results show that viewers tolerate high contrast when it serves an indicative or informative purpose. When contrasts are for indicative purposes, viewers prefer visual contrast. When the contrasts are for informatives viewers will accept the contrasts, but they do not prefer them,

meaning, viewers are able to remember the information, but they do not find it aesthetically pleasing.

Chapter 2 – Current Design Theory

Current design theory tends to lay out the different techniques available to the designer, with the understanding that “your audience expects to be dazzled” (Mansfield, 1996, p 5). So designers are forced to compete for audience attention. Table 2.1 shows examples of the typical recommendations designers are given. Included in Table 2.1 are alternative recommendations and the mixed recommendation. Alternative recommendations are those that do not contradict the typical recommendation, but they allude to an alternate use of the design element without clearly specifying that there are two distinct uses. Finally, mixed recommendations are those that completely ignore the possible different uses for the design elements and try to create one rule to cover the design element.

Design Element	Typical Recommendation	Alternative Recommendation	Mixed Recommendation
Color	Use color to create a unique feel to your page and to create unity in design. (Finkelstein, A. White, Whitbread)	Use color to draw attention to items, and communicate hierarchies, and send a message to the audience (Sammons, A. White, Finkelstein)	Use colors sparingly, limit color distinctions to one to two. (Sammons, Finkelstein)
Images	Images add interest and provoke emotional responses (Finkelstein, Hill)	Images can motivate, persuade, educate, and warn (Helmerts)	Images depend on written language to become intelligible. (Helmerts, Barthes)
Charts & Graphs	Add visual interest to charts and graphs by adding decorations to engage the audience. (J. Kraynack, Finkelstein)	“Chart junk” detracts from the data and should be limited or avoided. (Tufte)	Avoid exaggerations or trickery, but make the graphic interesting to the viewer. (J. White)
Text	Text only is boring, and doesn’t make a complete argument. (Finkelstein, Helmerts)	Use varied language and headings to engage and guide the viewer. (Bergström)	Create useful segregations to the text to guide the viewer through the information. (Sammons, Lynch & Horton)

Table 2.1 – Summary of major design items recommendations from design manuals

Chapter 3 will look at problems inherent in mixed recommendations. In this chapter, the discussion will focus on the typical and alternative recommendations that design manuals give.

The following discussion will look at each design element (color, images, charts & graphs, and text) individually. Each discussion will first look at the typical recommendation in detail first. Then the alternative recommendation will be covered for each individual element.

Color

Color is an “essential” part of any visual design project; different colors will send “different messages to the audience” (Finkelstein, 2003, p. 166). Color can add decorative interest to the page creating the overall feel of the design and adding visual appeal that attracts viewers to it. Every design manual recognizes the ability of color to create visual interest, so much so that manuals focus on guidelines that can “transform a ho-hum presentation into a forceful one” (p. 166).

Utilizing color to create a feel for the document is an important technique to master, because the “eye automatically seeks wholeness and unity” (A. White, 2002, p. 57). The first thing any viewer does is to take in the design as a whole. Whitbeard (2001) said that unity is “in the colour selection” and that the color scheme of the document could add “‘attitude’ to a piece” (p. 130). He continues this thought by pointing out that “colour can identify an organization or the type of document a reader is perusing” (p. 237).

The design manuals tell the designer to choose colors that ‘are appropriate to the topic’ or that ‘fit your organization and product’. For example, if advertising for a day at the beach, one would use the blues and greens of the ocean. If advertising for a barber shop, red and white would be more appropriate. Still other design manuals will give more ‘concrete’ advice about

color choice. Whitbread (2001) advised that “soft, dark and modified colours have an air of dignity and restraint” while “bright colours, or light colours...are exciting...brash and friendly.” (235)

When used appropriately, color can greatly aid in the document’s impact on the viewer. Color creates emotional responses in the viewer that can be used to encourage them to purchase a particular item or connect with an organization on an emotional level.

Most Microsoft Office products come with the ability to highlight text that the designer wants ‘called out’ and ‘emphasized’ for the viewer. Emphasizing items by using contrastive colors is no longer about creating a feeling, but about indicating specific things in the overall design. Whitbread (2001) thought that color lacked the ability of ‘communication’ and should be only used for creating ‘attraction’ with a viewer; however, color has a great ability to call attention to important information on the page. Alex White (2002) pointed out that color does have “the same potential for communicating hierarchy” as any other element on the page (65). Meaning, color can draw attention to specific parts of the information, as well as connect the parts to each other.

Sammons (2007) advises that color be used ‘sparingly’ for emphasizing the important information. She also reiterated White’s point that color can show relations to other items on the page. Color then has two distinct purposes, (1) to create a feeling for the design and (2) to indicate different items in the information presented; however, the design manuals are not always clear on this distinction, trying instead to give rules that encompass both uses without overtly acknowledging it.

Images

Images are those items that bear a close resemblance to a real world entity. This includes not only photographs but detailed drawings. Images are often added to a visual design to create visual interest because of their ability to “elicit more emotional response” than print messages which tend to garner “analytic responses” (Hill, 2004, p. 30). Design manuals state that images should be relevant to the document and placed where they do not interfere with the text.

Recall the examples given in the color discussion, not only should an advertisement for day at the beach use colors that are related to the beach, but an image of the beach would help to create a unified presentation. Adding scissors or a comb to a barbershop flyer will again add visual interest to the page, and help create a unified theme.

According to Whitbread (2001) the primary rule to remember with images is that no image is better than a poorly suited image. Consider Figure 2.1, the images are purely decorative, and have no relationship to each other, except that they are all animated.



Figure 2.1 – Images that are irrelevant to the document leave the viewer confused.
(<http://americanbeautyborder.com>)

Figure 2.1 was extracted from a website for a Border collie breeder, but based on the images; the viewer would never guess what the site’s purpose was. If the viewer drills down into other site pages, they eventually find images of the Border collie, but it takes some effort. In this situation,

no images would have been a better option; there is a disconnect between the images and the design's overall purpose.

Alternatively, design experts agree that images are also attention grabbers (Finkelstein, 2003, p. 118). Images “communicate: they motivate, persuade, or warn” the viewers (Helmets, 2006, p. 2). Images are not always simple decorations on the page, they can help solidify a point, or draw attention to it.

Design manuals offer suggestions on the use of images to aid in retention and to direct attention. Manning (1998) stated that “[images] serve as essential tools” in design (69). Images, when used correctly, can greatly aid the viewer in understanding the information being presented. When text and images are used together, “they operate synergetically” (Goggin, 2004, p. 88). They add to each other, and not against each other, but again the advice is to keep the images relevant, and placed near the information they are meant to explain.

Images are capable of adding visual interest to a page but they need to be related to the topic being discussed. This means that not only do images add decoration, but they also are able to help indicate what the overall design is all about. Designers are not explicitly told that images have this dual purpose, and they frequently will misuse images because of this.

Charts and Graphs

“Charting is one of the most exciting aspects of creating worksheets” or so believes J. Kraynak (2003) who continues “you can...transform even the dreariest collection of data into a dynamic graphic that illustrates how the numbers stack up” (p. 158). With the advent of the computer, designers were instructed to add interest to their charts and by adding images to them. If the bar chart was about the Gross National Product, make the bars out of stacks of cash. This

would spark the interest of the viewer, drawing them into the information more than just a plain bar chart would.

Other design manuals instruct the designers to change the shape, focus, aspect, etc of the charts and graphs to create visual interest. J. White (1984) instructed designers to slant their bar charts because this would “create immediate interesting in even the most jaded of viewers” (37). Still other advice tells designers to focus their decorations on the background of the chart or graph, but still designers are told that “there are...no rules to prevent you from using any shape the might make sense” (43). Designers were left to determine just what would work best for the chart without restraint.

Edward Tufte was the first graphic designer to point out that too much decoration would detract from the information being presented. He said “regardless of its cause, [decoration] is all non-data-ink...and is often chartjunk” (1983, 107). *Chartjunk* is Tufte’s way of defining anything that is added to a chart that does not augment the data. Tufte believed that “graphics do not become attractive and interesting through the addition of ornamental hatching and false perspective to a few bars. Chartjunk can turn bores into disaster but it can never rescue a thin data set” (121). In other words, focus on the data and not the decoration.

Designers are presented with conflicting information when it comes to charts and graphs. Some design manuals instruct the designer to create interesting charts and graphs, but others tell them to avoid decoration to preserve the data’s integrity.

Text

Visual designs of only text are “boring” and viewers will “tune out” (Finkelstein, 2003, p. 118). Helmers (2006) added that verbal language “is not the primary method of conveying an

argument or meaning” (p. 59). Design manuals tell designers to make the text interesting; otherwise, the viewers will not want to take the time to read the information being presented.

Design manuals encourage the use of bulleted (or numbered) lists (Sammons 2007, Finkelstein 2003) to break up the content so that viewers are able to quickly find the information. Images that depict the information can be added to the text to create visual interest. Still others suggest changing font size and color to call attention to specific items in the text.

Bergström (2008) claimed that it “isn’t the length [of text] that determines whether a text is read or not, it’s the reader’s interest” (116). Contrary to what other design manuals taught, Bergström thinks that a “well-worded” and “well-structured” text will be read (116). Viewers are not afraid of text, but afraid of boring text. Bergström proposed “language that varies in rhythm and tempo excites interest and encourages forward movement” from the viewers (115). He also encouraged the use of titles that “present or offer a hint about the content” so that the design “forcibly captures interest and stimulates the reader” (115).

Again designers are offered what appear to be conflicting instructions when it comes to the proper use of text in a document. Design manuals tell designers to add non-text elements to create interest so that viewers will read the information. Bergström believes that this is unnecessary as long as the text is written well.

Chapter 3 - Problems with Current Design Theory

Arnheim (1988) pointed out that design manuals cannot prescribe one set of rules and expect them to be universal because cultures can change perception. If universals were to be prescribed for design, the universals would have to be based on “deeply rooted...human nature” that was ultimately in “the very make up of our nervous system” (pg. 1-2). Most design manuals have shied away from dictating exactly what needs to be and not be in design, offering instead some basic advice with no solid theory to back it up.

This chapter will discuss the problems with design manual suggestions focusing on the mixed recommendations from Table 2.1. Then there will be a short discussion of common design myths and how the current research can help clear these up.

Mixed Recommendation

As documented in the previous chapter, design manuals are aware of color’s two distinct functions. Color has the ability “to communicate ideas and emotions, to manipulate perception, to create focus, to motivate and influence actions” (Holtzschue 2006, p. 5). Color functions as a way of decorating the design and as a way to direct the viewer’s attention to information. No design manual points out that the decorative function of color is fundamentally at odds with its indicative function. Instead, design manuals try creating rules that will handle both color functions.

Sammons (2007) instructed designers to “use no more than 2-3 colors per document” and to use “color sparingly to emphasize important information” (114-115). Figure 3.1 follows the 2-3 color rule, and uses a good contrast between the background and the font colors. However, it still would not be classified as good design.



Figure 3.1 – Following the advice to limit colors can still create bad design.
(<http://martinsburgpd.org>)

The colors chosen for this website make it difficult to read. The variegated background creates contrasts that are hard to process.

Kress and Van Leeuwen (2002) noted that color can increase attention spans by 80% (p. 350). However, incorrect use of the color, as noted, can block the viewer’s ability to assimilate the information because they are distracted. Farkas & Farkas (2002) pointed out that it, is in fact, “very easy to misuse color” and to exercise “restraint” in its use. (p. 247). Designers are left wondering what defines restraint? How much color (or any decoration) is too much?

Design manuals try to set a standard to make “minimal distinctions” that will allow for less visual clutter over all. Minimal distinctions allow the designer to increase the number of distinctions (Tufte, 1983, p. 77). George Agoston (1987) counters with the advice that large differences should be used to make the objects “as conspicuous as possible” (p. 92). Tufte (1997) encouraged the designer, again, to keep the information reachable by making only “just noticeable differences” to make the differences clear, but no more (73). This leaves the designer wondering which route to go.

Farkas and Farkas (2002) echoed this ideal, including all graphics as well, saying that

they should be limited to grabbing attention, but that overuse of such items (color, or any decorations) will detract from the information being presented. Sutherland and King (2003) believed that the right amount of contrast would result “in a pleasing and readable appearance. Too little contrast can make the text virtually unreadable. Too much contrast can make them visually jarring” (p. 215). These authors have merely reiterated what Tufte (1997) said above, and again they fail to identify what the point is where these elements change from being too little or too much color or contrast.

Images “cannot be separated from the text. [They] depend on written language to make [them] intelligible” (Helmets, 2006, p. 5). Bergström (2008) wrote that “images build messages—strong ones too—and they also set the stage for them” (124). He did not believe as Helmets did, though, he wrote “words and pictures clearly say different things but despite (or perhaps because of) this, they seem to be constantly drawn to one another” (221). So images, or real world representations, are both at odds with and dependent on the text. Designers are left to work out the proper relationship between images and their text.

Turning more specifically to charts and graphs, some design manuals believe that the sky is the limit. A. White (2004) stated that “the basic shapes of statistical charts and graphs... can be combined and elaborated *ad lib* and *ad infinitum*” (p. 101). However, Tufte (1983) would argue that such changes make for “chartjunk” and should be avoided. Tufte’s loyalty lies with the data, not the design variations possible for the data. With such conflicting arguments, the designer is left, again, to wonder where the tipping point from added attention to chartjunk is. Figure 3.2 shows a line graph where decorative figures have been added to exemplify the age groups being depicted.



Figure 3.2 – Adding visual interest to a line chart of a census count on age, distracts from the information (White, 1984, pg. 5)

Instead of creating visual interest and aiding the viewer’s comprehension, these figures get in the way of the information.

The purpose of a chart is to make large amounts of data digestible in a quicker fashion. Jan White (2004) warned that “graphic exaggerations or trickery” should be avoided, “unless ‘pictorialization’ makes the message more vivid and...more accessible” (p. 101). Charts, then, are not meant to be dull and boring, but should match the feel of the overall design and present the data in a clear way. Data should not be sacrificed in the name of decorations.

Not much is said on how to format the text of the visual, except to point out that it is essential to know how to properly format bullets points and paragraphs in a professionally designed document (Finkelstein, 2003, p. 96). There is discussion about how long these bulleted lists should be with people commonly citing Miller’s “The Magical Number Seven, Plus or Minus Two” (1956). The error that arises here is one of misunderstanding Miller’s work. Manuals commonly tell designers that lists of seven are great for retention. Miller’s work identifies seven to nine as the point where memory capacity breaks down, and the upper limit where errors in recall become unacceptable. Doumont (2002) pointed out that Miller’s research

actually states three to four as the more practical limit, where recall errors are rare (Alton & Manning, book chapter).

Types I, IV, and X above represent the terminal points of a large triangle. Each of these types can be described as the extreme manifestations of three basic rhetorical purposes:

(First) to decorate--

- to create a quality of feeling in the audience-
- borders, font shapes, color, etc., creating an overall feel for a document.

(Second) to indicate--

- to provoke an audience to action, locating, dividing, classifying, etc.-
- web links that can be clicked, action-activating buttons, page tabs that can be turned, etc.

(Third) to inform--

- to promote in an audience further understanding of some idea-
- stories, sales pitches, reports, explanations, etc.

Between the extremes of pure decoratives, pure indicatives and pure informatives there are a range of intermediate types.

- Diagrams and other kinds of technical graphics have definite aesthetic-decorative properties but they serve primary informative purposes, just as pure text does.

- Images likewise have strong aesthetic properties but unless carefully edited for aesthetics they serve primary indicative purposes, to represent specific things to an audience.

- Step-by-step instructions are in contrast a mix of strongly indicative and informative elements.

Figure 3.3 – By adding a list format and white space, information becomes more accessible (Amare & Manning, 2007, 62)

As shown, previous studies acknowledge, and encourage a balance in visual design, with restraint in the use of decoratives. But design manuals all lack a more precise definition, a threshold of where this balance is achieved. There are arbitrary rules given (less than 3 colors, minimal distinctions), but no actual measuring stick with which to measure. Amare and Manning (2005, 2006, 2008, 2009) recommend a theoretic framework based on the semiotic of C.S. Peirce. In the following chapter, this thesis will explain the framework and the implications the framework has on visual design. Each experiment was designed within this theoretic framework and the results are explained by Peircean theory. The results offer clear implications for design theory and design advice.

In design there are several common rules-of-thumb that are not consistently reliable. The discussion of Peirce in this thesis, as well as the results from the experiments, will allow for a better understanding of when these rules-of-thumb can be trusted and when they can't. This will be discussed further in the conclusion.

Chapter 4 – Peirce and Design Theory

In Chapter 2, the basics of Peirce were laid out. To review: firstness is feelings abstracted from perception; secondness is contrast that provokes action; thirdness is habitual patterns interpreted as asserted propositions. What now needs to be pointed out is how each of these categories relates to each other. Carmack's thesis *Technical Information Types: A Peircean Analysis* explains the relationship:

The notion of something being Second presumes that there is something that is First, so that the concept of Secondness really includes both the concepts of First and Second. For example, a given fact of occurrence (a Secondness), such as *I bumped my head*, includes the notion of a First state or a quality of being (namely, that I have a head) as well as the notion of a Second thing in opposition to the first (namely, that there exists a thing that bumped my head). Likewise, the notion of something being Third presumes that there is a First and a Second, so that the concept of Thirdness really includes the concepts of First, Second, and Third. For example, a given law of nature (a Thirdness), such as *two solid objects cannot occupy the same space*, includes both the notions of a First and a Second thing (namely a first and second solid object, such as my head and the kitchen cabinet) as well as the notion of a Third thing that relates to the First and Second thing (namely the law that governs the occupation of space for solid objects (2000, p. 55-56)

The reverse of this relationship does not apply. Secondness does not include Thirdness concepts, nor does Firstness contain concepts of Secondness or Thirdness. Understanding this interplay is important to the discussion on a theory of design.

Their interaction will allow us to build larger systems, systems that have been used in previous research, as discussed in Chapter 1. Young (2003) noted that "Firstness by its nature can hold nothing but itself" (p. 39). Meaning, any expansion that is created will be built out of Secondness and Thirdness; these categories contain the concepts of lower categories. Thus, Secondness contains Firstness and can expand to include two categories First of Secondness and Second of Secondness. Thirdness contains both Firstness and Secondness and can expand to contain blends as well. Figure 4.1 shows this expansion.

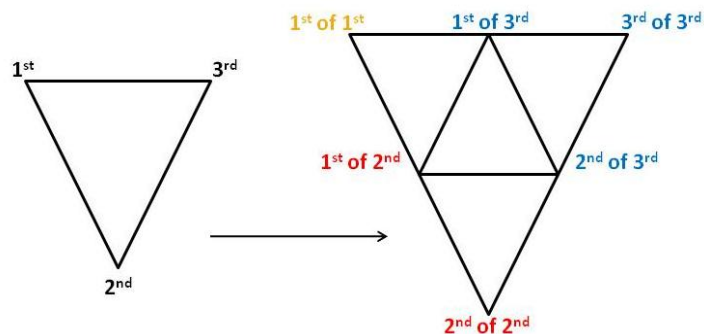


Figure 4.1 – Peircean Expansion from three to six.
Based on Roberston 1994, p. 182

This expansion of the structure allows for a six part system to emerge, and it maintains the original basic valency of the structure (Ketner and Percy, 1989, p. 3). Notice that each corner creates its own triad in the new system. For simplicity sake, a short hand can be used to talk about each of these new categories. First of Firstness is written as 1-1, First of Secondness is written as 1-2, and so on. (Robertson, 1994)

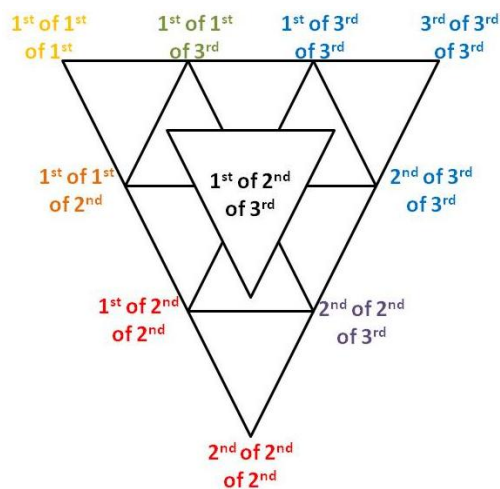
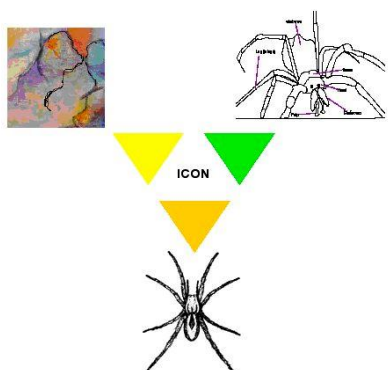


Figure 4.2 – Ten-Place Peircean system

Peirce used the ten place system just presented to develop more fully his concepts of icon, index, and symbol. This means that there are three icon subtypes, three index subtypes, and three symbol subtypes. To demonstrate this, Manning (2002) as quoted by Young (2003) used the example of the “spider.”

Icon

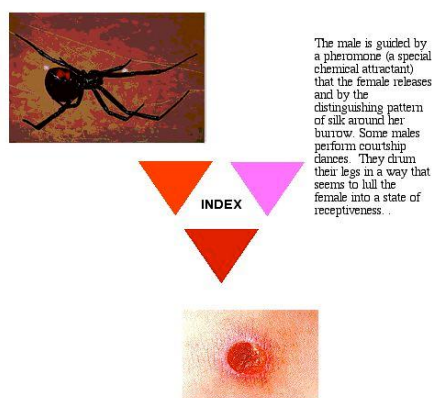


1st – Abstract spider-like quality

2nd – Image of a spider: drawing or photo. Actual representation of existence

3rd – Diagram of a spider. Law of spideriness.

Index

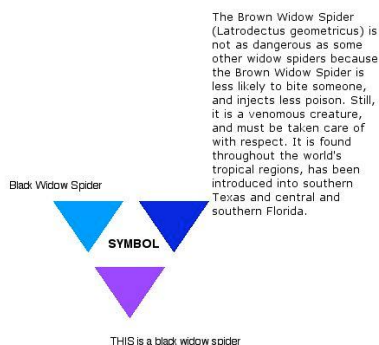


1st – Potential fright and utterance.

2nd – Actual pain and bleeding caused by spider biting.

3rd – Instinctive reaction to pheromones.

Symbol



1st – the word 'spider'; unlimited potential use

2nd – Proposition of spider existence

3rd – syllogistic argument on the nature of spiders

(The tenth category is also an index and is centered between these three. It is an article, as in "That", such as when uttered, pointing to a creature with eight legs.)

Jessica Young (2003) was able to use a ten-place system to expand her basic plot structure system to one that included plot types. Each of her plot types comes about because of their plot line characteristics. A creation story starts with chaos, has no real physical oppositions, and ends with a new beginning of some sort. Her ten plot types are listed, with example in Table

4.1 below.

Shorthand	Story Type	Example
1-1-1	Creation	<i>My Fair Lady</i>
1-1-2	Coming of Age	<i>Oliver Twist</i>
1-2-2	Adventure	<i>The Goonies</i>
2-2-2	Rivalry	<i>The Empire Strikes Back</i>
1-1-3	Self-Discovery	<i>While You Were Sleeping</i>
1-2-3	Temptation/Fall	<i>A Bug's Life</i>
2-2-3	Puzzle	<i>The Fifth Element</i>
1-3-3	Discovery	<i>Monster's Inc</i>
2-3-3	Sacrifice	<i>Braveheart</i>
3-3-3	Atonement	<i>The Matrix</i>

Table 4.1 – Young's Story Types (2003)

For Young's work, she defined stories in terms of their plot lines. Young's work focused on defining plot types based on their setting, conflict type, and resolutions. For the sake of this thesis, her work is discussed in the most basic terms to show the effective use of Peirce's Ten Place system.

The short hand used by Young (2003) above was referred to as "classes" by Peirce; though Young used them in her own way, each one still consists of three elements that are universal. The first place in the notation represents the quality of the class's form. The second place is the class's relationship to the object represented. The third place is the nature of the interpretation to be made by the class (Young 2003). These classes can be used to help define a more precise language to discuss design theory. For the purposes of this thesis the following naming system will be used to help define the different design functions.

Design Naming System:

Meaning of Place	Basic Form	Referential Process	Interpretation Type
Place	X ₁	X ₂	X ₃
Element Options	1 Qualities of Unity 2 Dynamic Sequence 3 Proposition Development	1 Qualities of Similarity 2 Physical Adjacency 3 Coded System	1 Qualities of Feeling 2 Physical Object Connection 3 Propositional Relationships

The reason the above table is included is to allow readers to interpret the numerical shorthand in Figure 4.3 below, but in brief the numbers indicate the relative degrees of Firstness, Secondness, and Thirdness that operate in each visual type.

Peirce and Design Theory

Peirce's ten sign types correspond with ten "distinct types of visuals" that are common in "modern discourse" (Manning & Amare, book manuscript).

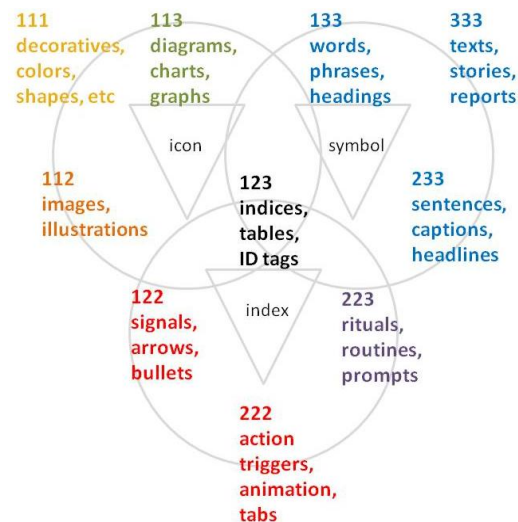


Figure 4.3 – Peirce's Ten-Place System

Each of these ten types will be talked about in turn in this chapter. The shorthand definition will be covered and explained in reference to each class of design element.

Decorative Icon – 1-1-1

Consider the following image. It contains brightly colored shapes and highly stylistic font.

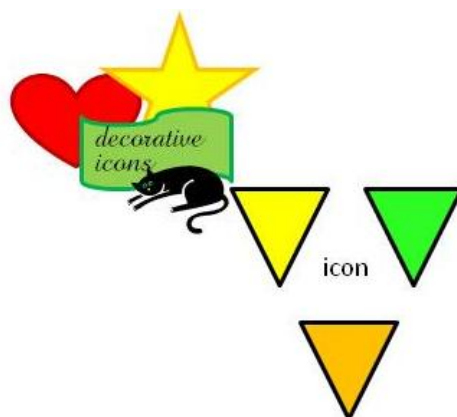


Figure 4.4 – Decorative Icons

Decoratives are defined as those items which primarily play to people’s emotions or create an “affect” on the page. As mentioned in previous chapters, color is primarily used to create a feel for the information. How does the designer know when something is meant to be a decoration rather than used to inform? If the item removed does not change the propositions, then it is a decorative feature and not one of proposition (Amare & Manning, book manuscript).

Different elements can be used to create a feel these are colors, shapes, fonts, images, borders, etc. A lack of these elements does not infer a lack of feeling, but actually is a feel: stark, plain, boring, etc. Designers can utilize decoratives to enhance the information on the page or to manipulate the emotions of the viewer. Well used decoratives can not only put the viewer at ease, but cause them to become agitated, motivated, concerned, empathetic, or inclined to act in some physical way to the visual.

Design Element	Basic Form	Referential Process	Interpretation Type
Decoratives	Qualities of Unity 1	Qualities of Similarity 1	Qualities of Feeling 1

To be effective, a decorative is used to create unity in the design; decorative elements should work together to create the overall aesthetic. If the decoratives contrast with each other, they fail as a decorative. Decoratives should create perceptual associations with in the viewer;

this means that the viewer is able to draw on past emotional experiences that are associated with the design. The only thing that a decorative can effectively communicate is a feeling. Putting too much of the information bearing load on decoratives will create the wrong feeling and the information will be ineffective.

Like all decoratives, backgrounds and borders need to add to the visual unity of the visual. The background and the borders create an expectation of unified form (Amare & Manning, book manuscript). If the designer interrupts any part of the border, or uses the wrong background, the viewer will be jarred. This need for unity tends to be only necessary in decoratives, indicatives forms need to create this jarring effect. Borders and backgrounds also need to be similar to the item that they augmenting. The information needs to be first, and the decoration needs to mirror that feel.



Figure 4.5 – Disrupted unity of message (Amare & Manning, book manuscript)

Putting the wrong background and border with the wrong message will create the wrong expectation from the viewer. These principles hold true throughout decorative designs.

Image Icons – 1-1-2

Unlike decoratives, image icons designate “visuals reflecting the actual physical appearance of objects” (Amare & Manning, book manuscript). Images are still partly decorative, by definition, but they bear a physical resemblance to some real world item, making them less decorative than colors, borders, and fonts. Images, because they are like all other decoratives,

cannot convey information. A image of a cat cannot teach the viewer about the different parts of the cat by itself, a detailed list must accompany it. A image’s meaning is open to interpretation without some form of added input.

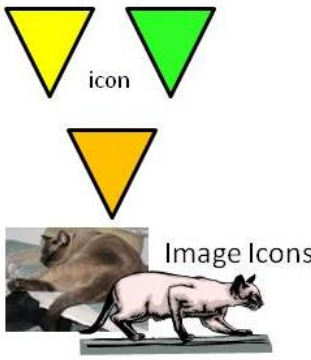


Figure 4.6 – Image Icons

The two main purposes of images are (1) to create the proper mood and (2) to indicate a particular object, person, or event. Images added to visuals that do not actually fulfill either of these purposes create problems for the viewer. Recall Figure 2.1, it had several different types of images, none of which were directly related to the website it was from. The site was meant to be about border collies, but the images were of penguins and ice cream and other non-connected items. Overuse of images is as big of a problem as using the wrong image.

Design Element	Basic Form	Referential Process	Interpretation Type
Images	Qualities of Unity 1	Qualities of Similarity 1	Physical Object Connection 2

Images also require that there be a quality of unity which means that pictures follow the same principles of design as decoratives. Images need to have balance, symmetry, and continuity. The image itself needs to have the unity within itself. If something disrupts that unity, then it no longer is a reflection of the original.

Images, like decoratives, have a reference through a quality of similarity. In Figure 4.6 above, the drawn image of the cat resembles that cat because of its similarity to the real thing. The photograph also has the quality of similarity because of the real life cat that it is a image of. This real-life indication takes images out of a state of pure feeling and into active indication. This means that images straddle feelings and real-world referents. Note that the interpretation type is that of Physical Object Connection and not one of propositional assertions, this is why a Peircean analysis can explain that images need text to explain them. Images by their very nature assert nothing, but they do point to some real world object. The terms *analogue* and *digital* are sometimes used to capture this same notion; however, the term *analogue* is not a primitive in the Peircean analysis since it combines both Firstness and Secondness reflections of reality. The term *digital* however, since it references interpretation based on a pattern system is more or less equivalent to Peirce's notion of Thirdness. The bottom line is that 'analogue' representations such as images cannot assert 'digital' (i.e. true or false) propositions.

Signaling Indices – 1-2-2

Signaling indices are use to draw attention to items in the visual design. These are things like arrows, bullet points, emphasized text, and contrastive color.

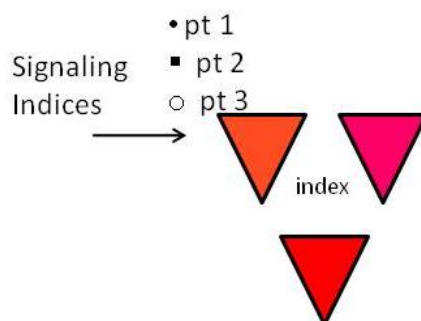


Figure 4.7 – Signaling Indices

Any index must be used carefully, because if it calls too much attention to itself it detracts from the item it is supposed to be emphasizing. This creates a visual design failure.

Pointing to items other than itself is the key difference between icons and indices. Decorative forms are meant to call attention to themselves, to be seen and taken in before moving to a new item. Indicative forms (signaling indices, and action indices later) are meant to draw minimal attention to themselves while directing the viewer to look at what it is near.

Design Element	Basic Form	Referential Process	Interpretation Type
Signaling Indices	Qualities of Unity 1	Physical Adjacency 2	Physical Object Connection 2

Like decoratives and images, signaling indices need to have a unified theme, and create minimal contrasts. Signaling indices must be near the item they are meant to highlight and they can only be interpreted by their physical connection to something else. A bullet point by itself serves no real function.

Action Indices – 2-2-2

Action indices are those items in a design that influence the viewer to *do* something. On a web page these would be things like a flash presentation, an animated image, or links that direct viewers to a new page. More generally, action indices must contain these two parts: (1) some signal that draws the visual attention, and (2) a *physical cause-effect chain* that creates some physical action.

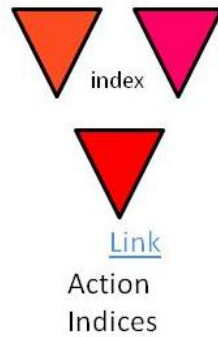


Figure 4.8 – Action Indices

Such physical actions can be, as mentioned, directing viewers to a new page, asking them to click their mouse again, flipping a page over, etc. In simple terms, Action indices can be explained as “I point, and you’ll look.” They are an action that the viewer reacts to reflexively. Too many of any index can lead to fatigue, overlooking of important points, and failure of the visual purpose (Amare & Manning, book manuscript).

Action indices are non-static elements that create some dynamic sequence; this is different from all previous design elements discussed because action indices are no longer static base forms (Type 1), but are dynamic (Type 2).

Design Element	Basic Form	Referential Process	Interpretation Type
Action Indices	Dynamic Sequence 2	Physical Adjacency 2	Physical Object Connection 2

Like Signaling Indices before it, Action indices must be physically connected to the sequence they trigger. Their interpretation type is to be a means of pointing towards something else. Action indices are not meant to be themselves seen, in the same way as decoratives or information, but to point out some other item that the viewer needs to be aware of.

These first four categories of design are known as the “leading edge of perception” (Amare & Manning, book manuscript). The “leading edge of perception” starts with decoratives

(1-1-1) which create a feel for the visual and ends with action indices (2-2-2) which create physical actions in the viewer.

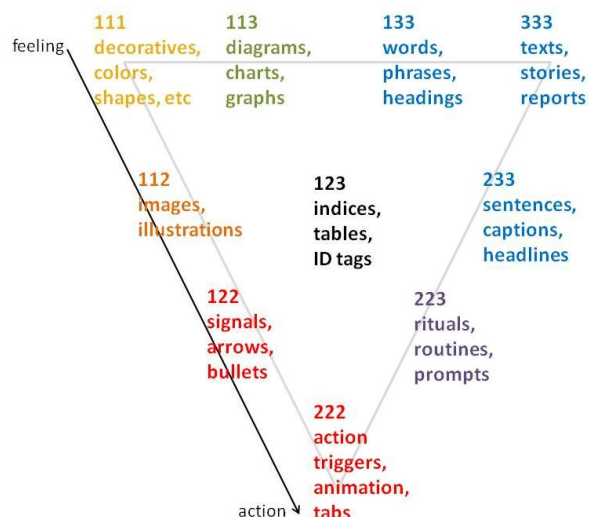


Figure 4.9 – Leading edge of perception

This leading edge is what viewers will take in first. Before the viewer can get to the information being presented they will take in the overall visual appeal, and be drawn to the indicative features. Some markets (gambling, for instance) take full advantage of this feeling-to-action cascade so that they can manipulate the viewer into doing what the markets want them to: gamble away their money in their casinos. If the purpose is to only create an action (such as buying a product) then the design will stay in this area; however, if the purpose is to inform, the design needs to move beyond action oriented marketing and into higher informative areas.

Informative Icons – 1-1-3

One way to move beyond the leading edge is to move away from images towards diagrams. Images, remember, can explain nothing by themselves. Diagrams of the same image can instruct the viewer on their own. Diagrams, charts, and graphs are defined as “any visual which represents by similarity as an icon, but which is interpreted in terms of conceptual,

conventionalized similarities...rather than in terms of feeling” (Amare & Manning, book manuscript, p. 49)

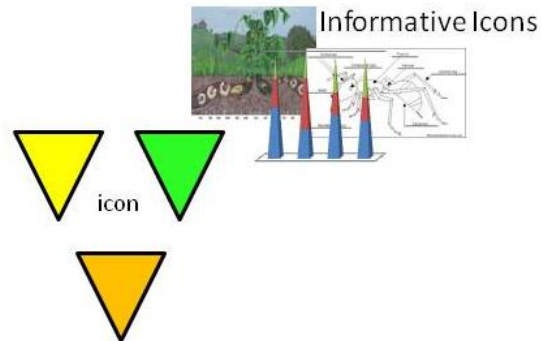


Figure 4.10 – Informative Icons

In other words, a diagram is any visual that is made to resemble objects or ideas in their basic part-to-part correspondences instead of their regular every day appearance. Diagrams are used to help educate and inform, which is their key difference from images or other decoratives.

Design Element	Basic Form	Referential Process	Interpretation Type
Diagrams	Qualities of Unity 1	Qualities of Similarity 1	Propositional Relationships 3

Like previous discussion, diagrams have to be unified in their presentation; small amounts of decorative touches are needed to make diagrams. Diagrams need to be able to attract the eye, and allow the viewer a chance to look over the diagram to glean the information. Unnecessary decoration prevents the diagram from being unified; therefore, diagrams should be kept to minimal contrasts. It is linked to the real world in the same way images and decoratives are: through feelings and perception of physical objects. Unlike decoratives and images, though, diagrams are interpreted by the propositions they assert. Their purpose is to inform the viewer.

Reference Indices 1-2-3

Reference indices are such things as tables and ordered lists (such as an index). These take the unorganized lists and create order around them.

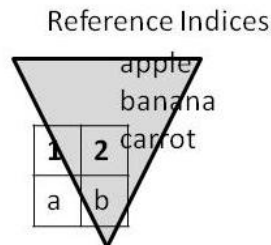


Figure 4.11 – Reference Indices

Normal signaling indices simply direct the viewer's attention to a detail, reference indices contain information independent of where they point. A table is a method to organize information so that each part of it is separated and highlighted in some way. Restaurant menus would fall under this type as well. Menus provoke the action of reviewing potential options (Firstness) displayed in a pattern (Thirdness) and making a choice and ordering a specific item (Secondness). The action created is not automatic or reflexive as the Action index mentioned before, where something is pointed out, so the viewer looks.

Design Element	Basic Form	Referential Process	Interpretation Type
Reference Indices	Qualities of Unity 1	Physical Adjacency 2	Propositional Relationships 3

Here, like signaling indices before, the reference indices must be unified in their organization.

An index must follow an organization pattern throughout, or it is just an unorganized list. Each item in this list points forward to the next item, or back to the previous item by virtue of its organization. To use (and interpret) reference indices the viewer must be informed of the logical

organization. This might seem like a drawback, but it actually gives the viewer more control over what they select.

Ritual Indices – 2-2-3

Like reference indices before, ritual indices are used to give viewers control over their information. Ritual indices are routines that viewers are used to participating in; they are sequences that are so familiar that they put the viewer in control of the actions to be taken. Any Build It Yourself furniture comes with a ritual index. The steps needed to build that piece are not organized randomly; they are fit into the logical steps needed to successfully complete the task. Note in Figure 4.12 the numbered list of steps; numbered steps put the control of action in the viewer’s hands. The viewer is able to see each step in conjunction (by physical adjacency) with the other steps.

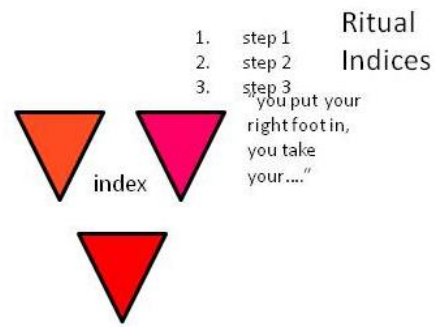


Figure 4.12 – Ritual Indices

Organizing information into common routines or rituals allows the viewer to go beyond simply doing what they are told, into acting on their own to complete tasks. Viewers are able to follow the process more openly.

Design Element	Basic Form	Referential Process	Interpretation Type
Ritual Indices	Dynamic Sequence 2	Physical Adjacency 2	Propositional Relationships 3

Like action triggers, ritual indices create a dynamic sequence for the viewer to participate in, but allow the viewer the ultimate control.

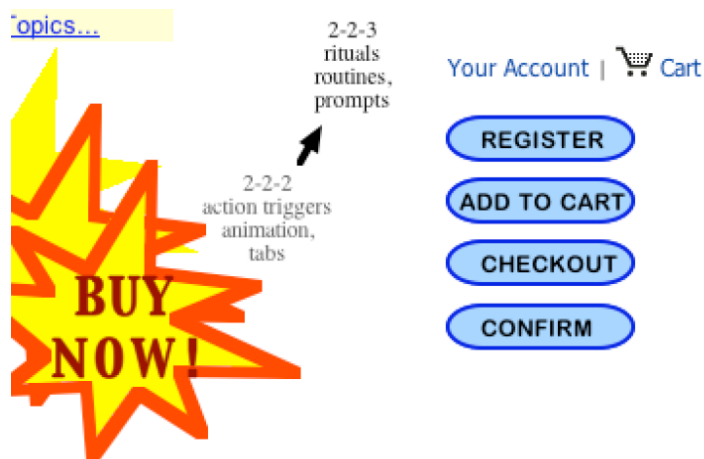


Figure 4.13 – Shopping Cart ritual (Amare & Manning, book manuscript, p. 78)

In Figure 4.13, a patron of the site would go from an action trigger of “buy now” to a ritual of the shopping cart. The viewer is still actively involved in the buying process, but the viewer is now doing so through a ritual they are familiar with. The viewer is able to see that they must (1) register with the site; (2) add the item to their “shopping cart;” and then they can (3) check out and (4) confirm their purchase. Each step physically points to the next by the proximity and organization of the ritual.

Symbols – 1-3-3, 2-3-3, & 3-3-3

Word-symbols is where Peirce’s theory allows visual design to take the text into account as part of the visual whole; most design theories focus on all aspects of the visual (decoratives, images, diagrams, etc) and leave out the actual words on the page. Visual designers and editors need to incorporate language back into the visual design process because words are visual.

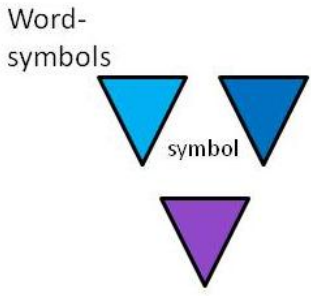


Figure 4.14 – Word-symbols

If words are visual, then the sentences that they create are also visual. Sentences can then be built in to larger systems of text, which are a separate type of symbol.

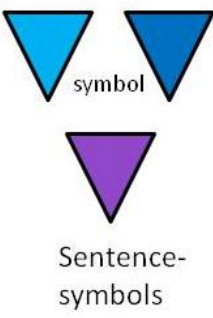


Figure 4.15 – Sentence-Symbols

Whole-text-symbols take the all the sentences as a unit, the viewer must process whole-text symbols in this way.

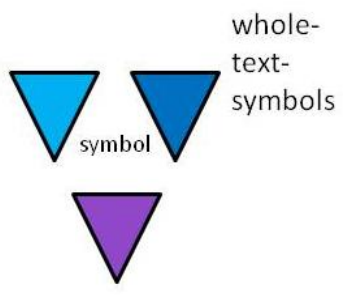


Figure 4.16 – Whole-Text-Symbols

Each of these symbols types comes with its own Peircean short hand and separate rules of proper formation. Word-symbols, and phrases that do not create sentences, (1-3-3) share some features

with decoratives, in that their basic form must be one of unity. Word-symbols are presented visually as their own single, static unit.

Design Element	Basic Form	Referential Process	Interpretation Type
Word-Symbols	Qualities of Unity 1	Coded System 3	Propositional Relationships 3

Unlike decorative words (and the sentences and whole-texts built from them) must be part of a coded language system. Without reference to that system, the viewer is unable to attach meanings to them.

Design Element	Basic Form	Referential Process	Interpretation Type
Sentence-Symbols	Dynamic Sequence 2	Coded System 3	Propositional Relationships 3

Sentence-symbols, unlike words, have a basic form similar to action indices and signal indices. Meaning sentences must consist of at least two distinct parts: in traditional grammars these two parts are *nouns* and *verbs*. In terms of dynamic sequencing, it could be said that the subject of the sentence moves dynamically to the predicate portion of the sentence.

Design Element	Basic Form	Referential Process	Interpretation Type
Whole-Text-Symbols	Proposition Development 3	Coded System 3	Propositional Relationships 3

Unique to whole-text-symbols is the basic form of *Proposition Development*. What this means is that any time there are three or more sentences grouped together, one sentence must be supported by at least two of the other sentences in the text.

Application to Research

Each of the experiments was built using these principle element distinctions. For any theoretic framework to be good, there needs to be empirical evidence to show that the principles

being taught work. The current research will show that viewers aesthetically prefer items on the leading edge of perception, but can recall information better when the design is moved away from that edge and into the upper right corner of the system, or into the symbols. Aesthetically, low contrast will be shown to be more appealing, but high contrast will prove to give better information recall.

Chapter 5 – Menu Design Experiment

This experiment focused on the use of color as both a decorative and an indicative.

Menus were designed based on the following elements as identified in Alton & Manning (2009):

- Decorative elements such as color, font choices, border forms, and attractive imagery that creates an overall feeling.
- Indicative elements such as bullet points, white space, arrows, and thumbnail imagery, each calling visual attention to separate items in the menu.
- Informative elements consisting of the phrases and sentences, helpfully organized into structures such as tables to aid viewers in processing the information.

The purpose of this study was to determine the interaction of these elements, both in how they support each other and how they interfere with each other.

There were three major variations used in the design of the menus. The first variation was in limited decoratives and color. The two menus in Figure 5.1 were designed in a table format. The one on the left, Menu 1, is black and white, so that the focus is solely on the information. The one on the right, Menu 2, adds a little visual interest by adding color to the background and text. The color here is purely for decorative purposes and not meant to highlight any specific items.



Figure 5.1 – Variation 1: Menu 1 and Menu 2, respectively

The second variation tested color as a decorative again, with balanced color schemes, added into

this now though is the use of color as an indicative. The category headings were now bannered with a different color than the background to call attention to them. In Figure 5.2, the menu on the right, Menu 4, offered a monochromatic color option while the menu on the left, Menu 3, offered more contrast between the decorative colors; however, Menu 3 minimizes the informative contrast by making the background a darker color.

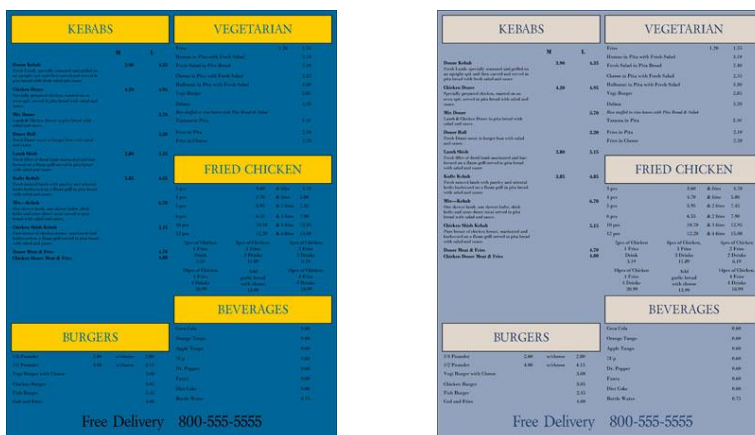


Figure 5.2 – Variation 2: Menu 3 and Menu 4, respectively

In the second variation there were also two menus using the same color schemes of Figure 5.2, but added images as indicatives.



Figure 5.3 – Variation 2 with images: Menu 5 and Menu 6, respectively

The final variation used many colors as decoratives, it also added decoratives elsewhere. More images were added detracting from their use as indicatives and pushing them more towards

decoratives.



Figure 5.4 – Variation 3: Menu 7 and Menu 8, respectively

Methodology

The methodology for this experiment was explained briefly in Alton and Manning's (2009) *Refining Specifications of Decorative/Indicative Balance in Menu Design*. Below the methodology will be laid out in more detail.

Participants

In this experiment fifty participants were randomly selected to evaluate the eight menus. Their ages ranged from 18 to 61; with an average age of 28.6. Of the fifty participants 27 were female and 23 were male. Of the participants 47 of them had at least some college, and 24 of them had graduated with a four year degree. The participants came from a wide range of backgrounds; a few of them were even internationals.

Questionnaire

The questionnaire consisted of five background questions to gather data about the participants. Each participant was asked to record their name, age, and gender. Participants were also asked to record their education level. For interest sake, participants were asked to record their favorite restaurant, this proved to have no bearing on the menu design preference.

After the background information the questionnaire asked the participants to rate each menu individually on a Likert scale. The scale was a simple scale of 1 to 5 with 1 being “Dislike [the menu]” and 5 being “Like [the menu]” and varying degrees in between, as illustrated in Figure 5.5.

1	2	3	4	5
Dislike it	Somewhat Dislike it	No Opinion	Somewhat Like It	Like It

Figure 5.5 – Likert Scale

The next part of the questionnaire asked the participants to compare each menu against different menus to determine which menus were preferred ultimately. The participants were also given space to comment on the design of each menu, should they want to. A copy of the questionnaire can be found in the appendices.

Procedure

Participants were seated at a table where each one was given their own stack of menu options to go through. Participants were instructed to only examine one menu at a time, and to answer the question before moving on to the next menu. Once participants had marked an answer they were not allowed to go back and change it based on any of the new menus. Each menu was removed as participants went through the stack.

After participants completed the first question and had recorded all their answers, they were presented with a series of comparisons and asked to pick the menu that they preferred from each comparison. The comparisons were based on similarities in design so that the research would show not only the appeal of each individual menu, but which menus were preferred when presented with other options.

Finally, the participants were given time to explain what they did and did not like about each menu. Participants were not required to fill in this question, but were asked to complete it so that future studies could be better built. This experiment was not timed, the participants were allowed as much time as they needed to complete each task.

Results

After the surveys were completed all the information was entered into a spread sheet. Each question was processed in a separate manner that fit the data collected. Each ranking in question one were compiled in a list form for each menu. All the rankings were added together to determine the total amount of “points” awarded for each menu. For example, if someone ranked Menu 1 as “5 – Like It” then Menu 1 was allotted 5 points for that response. Table 5.1 shows the total points per menu.

	Total Pts
Menu 1	145
Menu 2	176
Menu 3	86
Menu 4	159
Menu 5	132
Menu 6	191
Menu 7	119
Menu 8	79

Table 5.1 – Total points per Menu

This calculation shows the preference of each individual menu. The next step for question one was to total each menu’s total number of responses for each of the Likert Scale’s options. Table 5.2 shows these rankings.

	1	2	3	4	5
Menu 1	9	11	10	16	4
Menu 2	2	10	8	20	10
Menu 3	23	22	1	4	0
Menu 4	3	15	9	16	7
Menu 5	7	19	12	9	3
Menu 6	1	5	7	26	11
Menu 7	21	9	5	10	5
Menu 8	35	7	2	6	0

Table 5.2 – Likert Scale rankings for each Menu

What Table 5.2 is able to show, is how each menu received the total points allotted by the participants. It is able to show the underlying preference patterns that Table 5.1 lacks.

The last data set collected from the participants is that of the comparisons. Each time a particular menu “won” over the other menu option it was allotted one “point.” These points were totaled and the preferred menus are shown in Table 5.3.

	Winner (Total)	Loser (Total)
Menu 1 or 2	2 (42)	1 (8)
Menu 2 or 3	2 (40)	3 (2)
Menu 2 or 4	2 (23)	4 (18)
Menu 3 or 4	4 (47)	3 (3)
Menu 3 or 5	5 (40)	3 (9)
Menu 4 or 6	6 (30)	4 (20)
Menu 5 or 6	6 (45)	5 (4)
Menu 6 or 7	6 (42)	7 (3)
Menu 6 or 8	6 (44)	8 (1)
Menu 7 or 8	7 (45)	8 (4)

Table 5.3 – Comparison totals

In Table 5.3 the winning design is listed followed by the total number of “votes” for that menu in parenthesis. The same is done for the losing designs.

The last set of questions were not weighted and scored in any way. These responses were collected and analyzed for what the participants did and did not like about each menu. The responses will be used in future research.

Analysis

The data shows that the menu design preference of the participants conforms with the theory that was laid out in Chapter 4. Participants preferred the menus that had a unified color scheme and few indicative features. Recall in Chapter Two that design manuals instruct designers to use two to three colors and to make minimal distinctions between them. This is all in an effort to create unity on the page and a feeling of harmony between the elements. As mentioned in Chapter Four, indicatives require some action to be met when they are encountered. In the menus the images of the food required that the viewer then find that item on the page so that they could get more information. Too many indicative images and the viewer lost interest in the menu, thus ranking it lower than those with fewer images. It is interesting to note that some participants mentioned that they like having images because “it allowed them to see what they would be getting.”

In Figure 5.6, each menu is placed on a graph where the horizontal axis shows the increase of contrast, colors, and images and the vertical axis shows the participants overall preference for each menu. It is interesting to note that Menu 1 (145 points) which lacked any extra design beyond a simple tabular construction scored better than most of the other menus. When a small amount of color was added, Menu 2 (176 points) tested still better, being out preferred by only one menu.

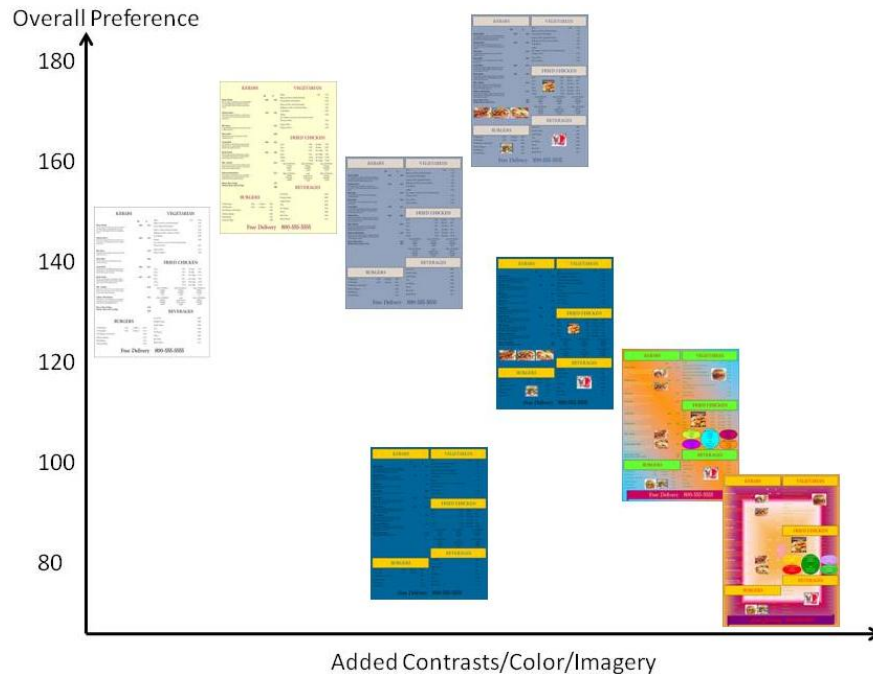


Figure 5.6 – Effects of added design features on overall preference

Based on this chart it is clear the participants preferred Menus 2, 4, and 6 over all the other menus presented. Each of these menus has visual interest, but this visual interest operates well below a definite threshold (Alton & Manning 2009).

As mentioned previously, any indicative will take a mental toll on the person viewing it. Indicatives are created by the use of contrasting elements, in terms of the menu each item has to be contrasted with the other items and each section with the others. Contrasts created for decoratives will not always affect the viewer negatively as evidenced by Menus 2, 4, 6, but when the colors create high contrast they can take a similar toll as seen in Menu 3. This menu only added two colors, but the high contrast interfered with the indicative processing, thus fatiguing the viewer more quickly.

Looking back at Figure 5.4 again, it can now be explained why each menu ranked the way it did. Menu 2 increased because color, but not contrast, was added to the menu. Menu 4, on the other hand, adds color but also contrast with boxes around the headers for each section. Its

score is higher than the plain Menu 1, but not as much. The reason that Menu 6 does so well, is that the decorative images of food not only add visual interest to the page but they also add indication of the food categories they represent. These two things work together to increase the preference rating, making it the optimal menu selection.

Chapter 6 – Diagram Design Experiment

Like the previous experiment, this experiment examined the use of color and images as indicatives, but also investigated the use of text in comparison to diagrams for accuracy in information processing. The diagrams were based on a diagram from Tufte's (1983) book, *The Visual Display of Quantitative Information*, and incorporated the following elements:

- Decorative elements such as color, and attractive imagery that creates an overall feeling.
- Indicative elements such as lines, white space, arrows, and thumbnail imagery, each calling visual attention to separate phases in the Japanese beetle's life.
- Informative elements consisting of the phrases and sentences.

The purpose of this study was to determine the interaction of these elements, both in how they support each other and how they interfere with each other during information processing.

There were three major variations used in the design of the information. The first variation used photographs of each stage in the beetle's life to add both visual interest and indicative contrast to the diagram. The images were done in full color, adding to the indicative contrasts of the images. Lines were added to the diagram to help delineate each month of the year. Also, there is a horizontal line in the middle of the diagram to indicate ground level, adding both a visual break to the design and an indication of where the stages of life occur in reference to the real world.

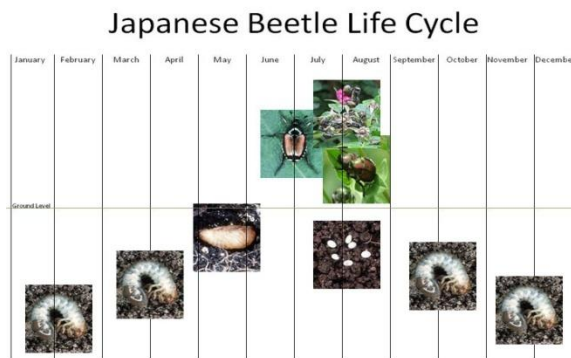


Figure 6.1 – Bug’s Life 1

The second variation had no decorative features; it was designed as a simple text paragraph that relayed the phases of the Japanese beetle’s life. Like Bugs Life 1, this option had a heading at the top of the page, but with not added interest. Figure 6.2 shows the text was a short paragraph with normal sentence structure. This option best presented the information in a clear way.

Japanese Beetle Life Cycle

The life cycle of the Japanese beetle is a five part process. They start out as eggs in July and slowly grow into larvae over the fall and winter months. They are distinguishably larvae starting in September, and are full grown larvae during November and December. After this point they start developing into pupas. In May they are fully developed pupas and start the quick change into a beetle. During June the beetle emerges from the ground as a full grown beetle where it will eat leaves. In July the beetles will mate and lay eggs for the next year. Beetles die during the month of September.

Figure 6.2 – Bug’s Life 2

The final variation used drawn images of the beetle’s life cycle. Like Figure 6.1, there are lines to show each month of the year. Instead of having a simple line to mark ground level, this is shown through the drawn background. Figure 6.3 shows the black and white option of the diagram. This figure shows uses a darker shade to denote below ground level, and added some decoratively drawn grass to the ground level of the visual.

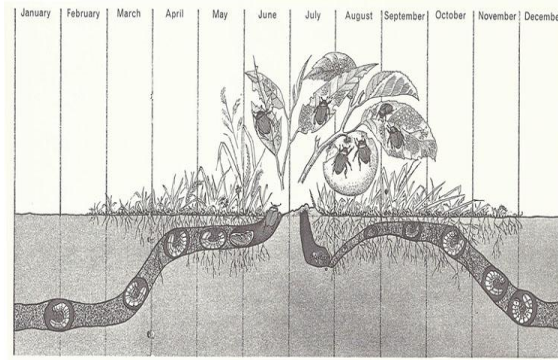


Figure 6.3 – Bug's Life 3

In Figure 6.4, color has been added which increases the indicative contrast, as well as increasing the decorative interest. As mentioned in Chapter 5, increases to the decoration are fine when the increase does not interfere with the indicative contrasts. Here the months are shown along the bottom of the visual and the lines marking them do not extend through the whole diagram, thus allowing the visual to be unbroken.

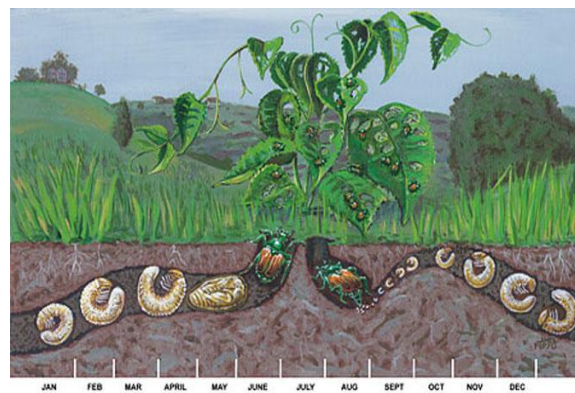


Figure 6.4 – Bug's Life 4

Methodology

This experiment was set up in much the same way as the first experiment. A recall accuracy test was added to this experiment. The experiment was ran with the aid of Qualtrics online survey system

Participants

In this experiment fifty participants were randomly selected to evaluate the four

diagrams. Their ages ranged from 20 to 58; with an average age of 28.9. Of the fifty participants 38 were female and 12 were male. Of the participants 50 of them had at least some college, and 34 of them had graduated with a four year degree.

Survey

The questionnaire consisted of three background questions to gather data about the participants. Each participant was asked to record their age, and gender. Participants were also asked to record their education level.

After the background information the survey presented the participants with one of the four images. Each option was followed with the same three questions.

- In what month do Japanese Beetles lay eggs?
- In what month do Japanese Beetles develop into full grown larva?
- In what month do the Japanese Beetles die?

After the questions were answered, the participants ranked each option on the same Likert scale as the first Experiment. To review: the scale was a simple scale of 1 to 5 with 1 being “Dislike [the menu]” and 5 being “Like [the menu]” and varying degrees in between. Screen shots of this survey can be found in the appendices.

Procedure

Participants were asked to follow a link to the online survey. Participants were first presented with a consent form that they had to agree to before moving on to the rest of the survey. Participants were instructed to only examine the option for 1 minute after which they moved on to the question portion of the survey. The survey was set to not allow the participant to look back at the option while answering the questions. Once participants had answered all three questions, they were allowed to move on to the next part of the survey.

After participants completed the first questions and had recorded all their answers, they were presented with all four possible options and asked to rank them on a Likert Scale from one to five. The instructions asked them to rank them based on visual interest only. After ranking each individual diagram, participants were asked to rank the diagrams on their general usefulness. Participants were asked to rank them in reference to each other. So if participants ranked Bug's Life 1 as the least useful option, they could not rank Bug's Life 2 in the same position.

Finally, the participants were given time to explain what they did and did not like about each diagram. Participants were not required to fill in this question, but were asked to complete it so that future studies could be better built. This experiment was not timed, the participants were allowed as much time as they needed to complete each task.

Results

After the surveys were completed all the information was entered into a spread sheet. Each question was processed in a separate manner that fit the data collected. Each ranking in question one were compiled in a list form for each diagram. All the rankings were added together to determine the total amount of "points" awarded for each diagram. For example, if someone ranked Bug's Life 1 as "5 – Like It" then Bug's Life 1 was allotted 5 points for that response. Table 6.1 shows the total points per diagram.

	Total Pts
Bug's Life 1	81
Bug's Life 2	171
Bug's Life 3	150
Bug's Life 4	205

Table 6.1 – Total Points per Diagram

This calculation shows the preference of each individual diagram. The next step for question one was to total each diagram's total number of responses for each of the Likert Scale's options.

Table 6.2 shows these rankings.

	1	2	3	4	5
Bug's Life 1	8	16	9	10	7
Bug's Life 2	6	10	6	13	15
Bug's Life 3	9	9	11	15	6
Bug's Life 4	2	3	4	20	21

Table 6.2 – Likert Scale rankings for each Diagram

What Table 6.2 is able to show is how each diagram received the total points allotted by the participants. It is able to show the underlying preference patterns that Table 6.1 lacks.

The next data set collected from the participants is that of the usefulness ranking. Each diagram was ranked with respect to the other three options on a scale of one to four for usefulness; where 1 was the most useful option and 4 was the least useful. Each time a diagram was ranked as a 1, it was given a "point" these points were counted to determine how many times each diagram was ranked in each position. Table 6.3 shows the totals for each ranking.

	Bug's Life 1	Bug's Life 2	Bug's Life 3	Bug's Life 4
1	5	31	2	12
2	12	5	9	24
3	13	4	24	9
4	20	10	15	5

Table 6.3 – Usefulness rankings

In Table 6.3, the rankings allow us to see that each of the different options presented had a clear perception of usefulness by the participants.

The last thing that needs to be discussed is how well the participants scored on the recall questions. In Table 6.4, the percent of correct answers are shown for each diagram option. To

calculate the percentages, the total number of correct answers were tabulated with reference to the visual presented. This number of total right answers was divided by the total number of answers. The resulting percentage is shown in Table 6.4.

	Percent Correct Answers
Bug's Life 1	55%
Bug's Life 2	40%
Bug's Life 3	44%
Bug's Life 4	45%

Table 6.4 – Percentage of correct answers in information recall

The last set of questions were not weighted and scored in any way. These responses were collected and analyzed for what the participants did and did not like about each diagram. The responses will be used in future research.

Analysis

Like the Menu experiment before it, this experiment's results conformed to the principles laid out in Chapter 4. The participants preferred Bug's Life 4 to any other option with a total of 205 points awarded in the visual preferences scale. This option offered a balance of both decorative and indicative design features. Bug's Life 1 (81 points) had colored photographs adding visual interest, but the contrast was just enough more than Bug's Life 4 to drag the preference score drastically. Even the plain text option scored higher than the image option, at 170 points. Figure 6.5 shows the effect of added contrast, colors, and imagery on the overall preference of each of the options. It is also interesting to point out, that the participants would rather see plain text than a black and white drawn visual.

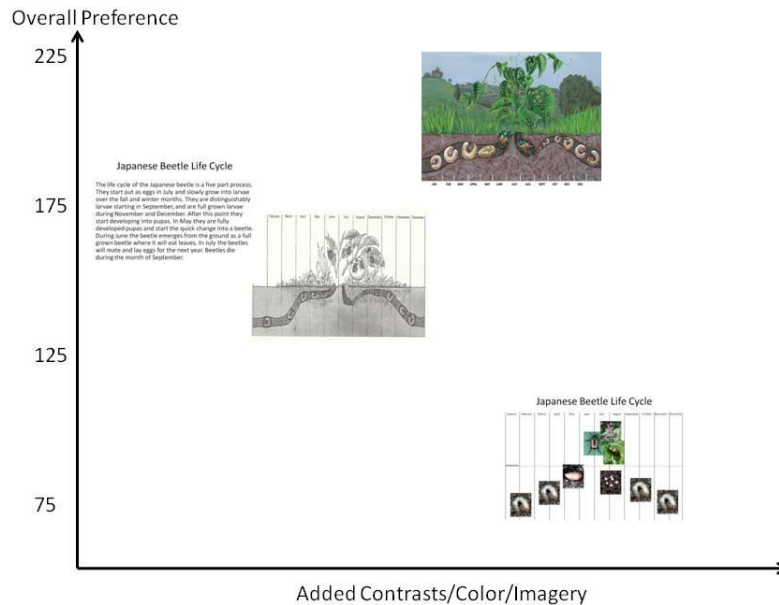


Figure 6.5 – Overall visual preference in terms of increased contrasts/color/imagery

Figure 6.6 contrasts the added color, contrasts, and imagery with the participant's ability to recall key information from the diagrams. Even though the participants visually preferred the drawn, colored diagram to the diagram made with images, the participants recalled information more accurately from the images. Here, the accuracy increased with the use of more contrastive elements. Bug's Life 1 (55% accuracy) was able to find a balance between decoration and informative contrast. Though, this was not the preferred option for overall feel, the balance aided in memory recall. The text option gave all the pertinent information in prose, but failed to perform as well in information recall. This illustrates the point of Chapter 5, when it was said that sentences (information) are part of visual design and that visual design is in fact information issues (Alton & Manning, book chapter).

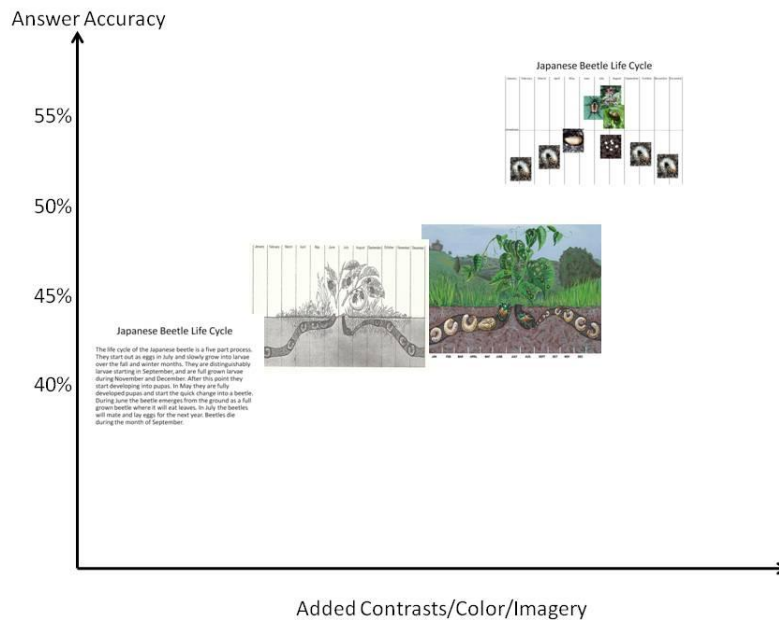


Figure 6.6 – Answer accuracy in terms of increased contrasts/color/imagery

The study did not, however, have any of the designs so overloaded with extra decoratives or indicatives to the point that information is lost in the design. Future research will try to find this threshold.

When comparing preference with accuracy, participants did not prefer the Bug's Life 1 even though it was the one that offered the highest level of recall. The Bug's Life 4 (45% accuracy) did not test significantly higher than its black and white counterpart (44% accuracy). The higher level of contrast in Bug's Life 1 required a bit more work from the viewers, but ultimately allowed for more visual distinction enabling better information retention than the highly decorative color diagram (Bug's Life 4).

Chapter 7 – Bar Charts Experiment

Like the previous experiments, this experiment investigated the use of color and images as indicatives, but added depth as a counterpoint to the designs. A table was used as a comparative to the bar charts in information processing. The diagrams were charts based on the following elements:

- Decorative elements such as color, depth, and attractive imagery that creates an overall feeling.
- Indicative elements such as lines, white space, and color, each calling visual attention to different information in the charts.
- Informative elements consisting of words, phrases and sentences.

The purpose of this study was to determine the interaction of these elements, both in how they support each other and how they interfere with each other during information processing.

There were five major variations used in the design of the information. The first variation used black and white bar charts to communicate the amount of commissions paid in each year. The bar chart on the right of Figure 7.1 added depth to the data to create some visual interest. Lines were used to help mark each dollar amount, in millions of dollars. In the 3D option, the lines wrapped around the chart which aided in determining the dollar amount. The third set of bars were marked as being for only the first half of 1978. All other years reported full years.

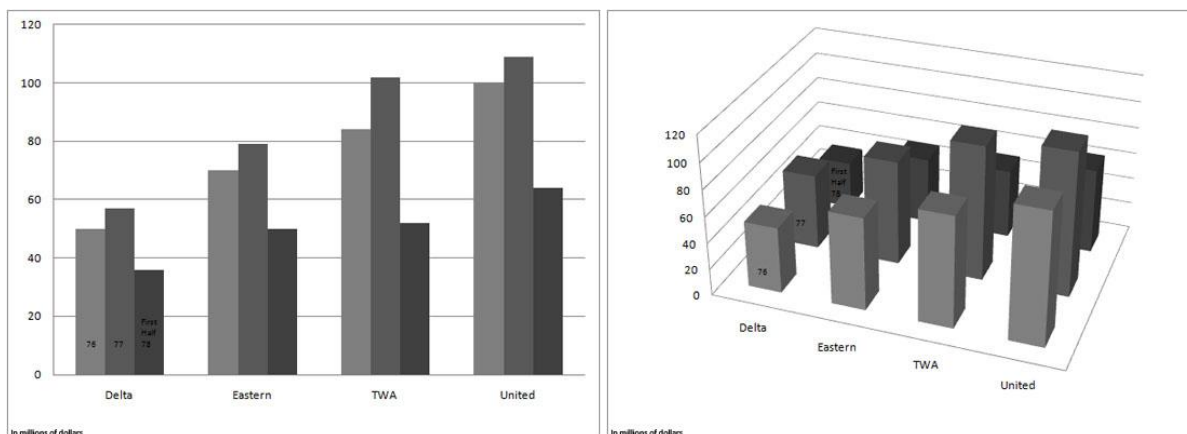


Figure 7.1 – Variation 1: Bar Chart 1 and Bar Chart 2

The second variation added a muted color scheme for both decorative and indicative purposes. These charts were designed in the exact same way as the first variation, except for the added color. Figure 7.2 shows these variations. Like the 3D chart before, the base was rotated to help the viewer distinguish the three sets of bars.

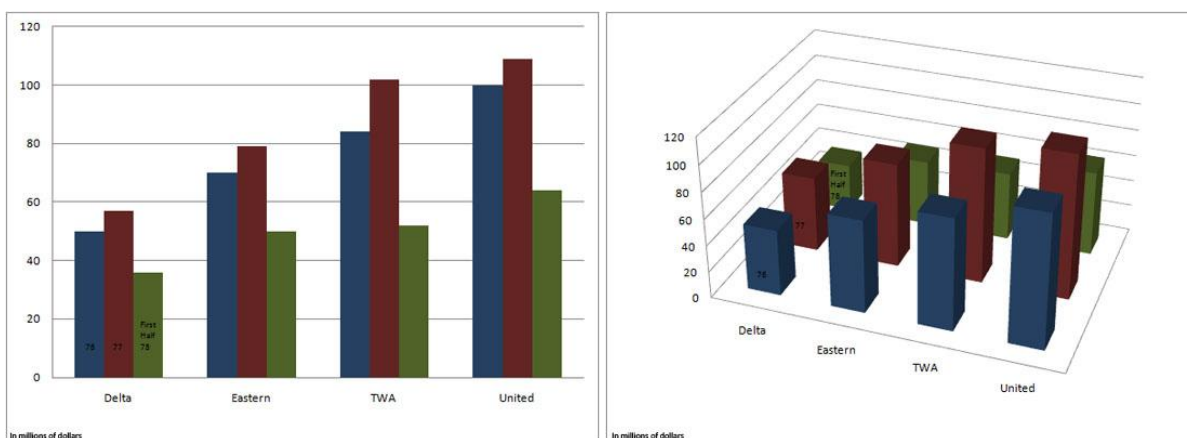


Figure 7.2 – Variation 2: Bar Chart 3 and Bar Chart 4

The third variation added brighter colors than before to be used indicatively to mark the three separate years, like variation 2. Unlike the previous variations, a bright yellow color was added to be purely decorative. Also added in on this variation were images of each airline's logo instead of simple text to distinguish the airlines that paid commissions during the three years in question. Figure 7.3 shows these variations. What has been described here do constitute two distinct changes; however, the overall effect of the two changes results in the same purpose:

increased visual contrasts moving away from complete visual unity.

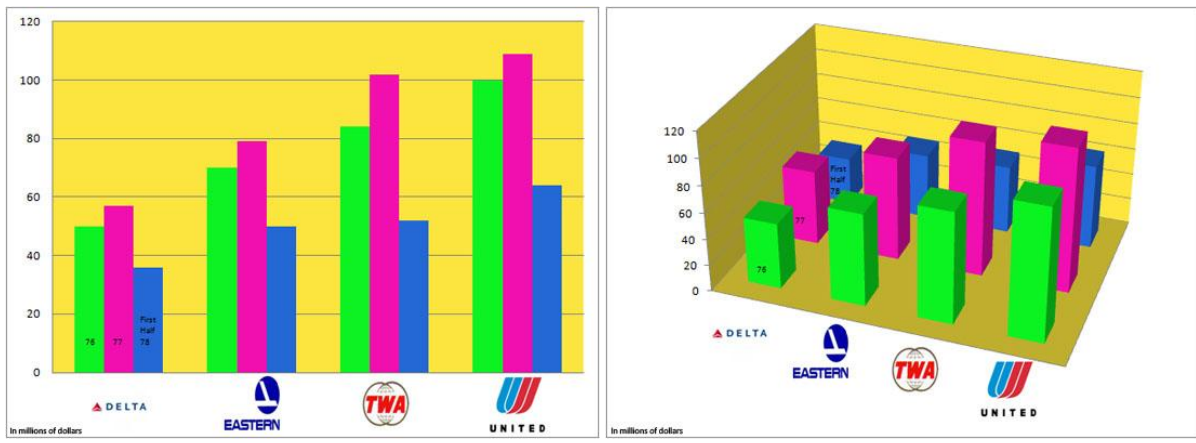


Figure 7.3 – Variation 3: Bar Chart 5 and Bar Chart 6

In Figure 7.4, the fourth variation added even more color variation to the bars, increasing the contrast for visual interest sake. Instead of a solid color background, a photograph was added to the background for decorative purposes. The logos were maintained from variation 3. The lines marking each dollar amount are harder to see due to the image.

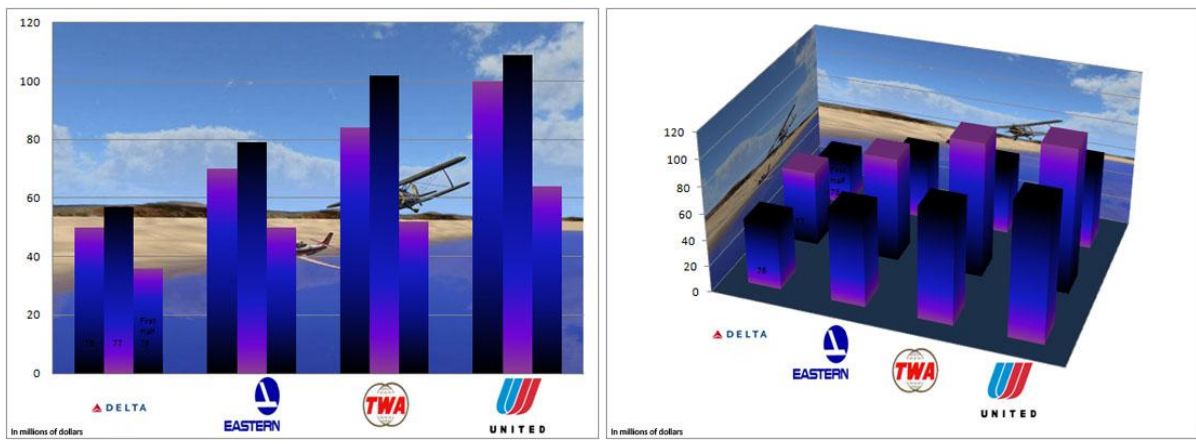


Figure 7.4 – Variation 4: Bar Chart 7 and Bar Chart 8

The final variation was a simple table of the commissions paid in all three years recorded. There were no decorations added to the table, nor were there any indicatives added beyond the table itself. Figure 7.5 shows the table.

	76	77	First Half 78
Delta	50	57	36
Eastern	70	79	50
TWA	84	102	52
United	100	109	64

In millions of dollars

Figure 7.5 – Table 1

Methodology

This experiment deviated from the previous studies in several ways. Like the first two experiments, each participant was presented with one of four options and asked to recall information from it. Unlike the previous studies, the participants were asked specific questions about the designs of the charts for comparison. No Likert scale was presented in this study. The experiment was run with the aid of Qualtrics online survey system. After completion of the initial survey, a follow-up survey was run for Likert rankings on preference.

Participants

In this experiment fifty participants were randomly selected to evaluate the four diagrams. Their ages ranged from 23 to 62; with an average age of 32. Of the fifty participants 38 were female and 12 were male. Of the participants 47 of them had at least some college, and 31 of them had graduated with a four year degree.

Survey

The questionnaire consisted of three background questions to gather data about the participants. Each participant was asked to record their age, and gender. Participants were also asked to record their education level.

After the background information the survey presented the participants with one of the four images. The four options chosen for this part of the experiment were the table, the bright colored bar charts of variation 3 (Bar Charts 5 and 6), and the black and white 2D bar chart (Bar Chart 1). Each option was followed with the same three questions.

- In which year did United pay more in commissions?
- In 78, which company paid more commissions?
- What accounts for the relatively lower amounts in the last year?

After the questions were answered, the participants were presented with a series of comparisons. The first comparison asked participants to consider two 2D charts: the chart with color variation and a image back ground (Bar Chart 7) and the bright colored chart (Bar Chart 3). Participants were asked the following questions:

- In which option are the dates easiest to read?
- In which option are the totals easier to discern?

The second comparison presented the participants with both charts from variation 2 (Bar Charts 3 and 4). Participants were then asked to answer the following questions:

- Which is more visually interesting?
- Which is easier to read?

The third comparison presented the participants were presented with two 3D charts: the chart with color variation in the bars and a image background (Bar Chart 8) and the black and white chart (Bar Chart2). Participants were then asked the following questions:

- Which option is more visually intriguing and/or pleasing?
- In which option is it easier to see that '78 is only for half a year?

The last comparison presented the participants with the simple table and the black and white 2D bar chart (Bar Chart 1). The following questions were then presented to the participants:

- Which option presents the information in the most usable manner (easiest to understand/read)?
- Which option is more visually interesting?

Procedure

Participants were asked to follow a link to the online survey. Participants were first presented with a consent form that they had to agree to before moving on to the rest of the survey. Participants were instructed to only examine the option for 1 minute after which they moved on to the question portion of the survey. The survey was set to not allow the participant to look back at the option while answering the questions. Once participants had answered all three questions, they were allowed to move on to the next part of the survey.

After participants completed the first questions and had recorded all their answers, they were presented with a series of comparisons as outlined in the previous section. Each question had the set answers of either 'option 1' or 'option 2'. After participants answered all the comparison questions they were done with the survey.

Follow Up Survey

The follow up survey was run to gather the information on visual preference of participants.

Participants

In this follow up survey, forty-eight participants were randomly selected to evaluate the four diagrams. Their ages ranged from 24 to 63; with an average age of 37.5. Of the forty-eight participants 39 were female and 9 were male. Of the participants 45 of them had at least some college, and 36 of them had graduated with a four year degree.

Survey

Each participant was presented with all of the variation bar charts and the table. Participants were asked to rank them on the same Likert scale as presented in the first two experiments. After participants answered all the Likert scale questions, they were presented with the same background questions as before. Screen shots of each of these surveys in this experiment can be found in the appendices.

Results

After the surveys were completed all the information was entered into a spread sheet. Each question was processed in a separate manner that fit the data collected. Like the previous experiments, each ranking in the follow up survey were compiled in a list form for each bar cart. All the rankings were added together to determine the total amount of “points” awarded for each bar chart. For example, if someone ranked the Table option as “5 – Like It” then it was allotted 5 points for that response. Table 7.1 shows the total points per bar chart.

	Total Pts
Bar Chart 1	138
Bar Chart 2	98
Bar Chart 3	193
Bar Chart 4	174
Bar Chart 5	179
Bar Chart 6	184
Bar Chart 7	139
Bar Chart 8	135
Table 1	122

Table 7.1 – Total Points per Chart

This calculation shows the preference of each individual bar chart. The next step for the follow up was to total each bar chart’s total number of responses for each of the Likert Scale’s options. Table 7.2 shows these rankings.

	1	2	3	4	5
Bar Chart 1	4	17	11	13	3
Bar Chart 2	18	17	8	3	2
Bar Chart 3	1	1	12	16	18
Bar Chart 4	2	3	15	19	9
Bar Chart 5	4	8	5	11	20
Bar Chart 6	6	5	5	7	25
Bar Chart 7	13	8	7	11	9
Bar Chart 8	15	9	4	10	10
Table 1	13	11	14	5	5

Table 7.2 – Likert Scale rankings for each Chart

What Table 7.2 is able to show is how each bar chart received the total points allotted by the participants. It is able to show the underlying preference patterns that Table 7.1 lacks.

Returning to the initial survey for the bar charts, the recall questions can be analyzed to show how well each option informed the participants. In Table 7.3, the percent of correct answers are shown for each diagram option. To calculate the percentages, the total number of correct answers were tabulated with reference to the visual presented. This number of total right answers was divided by the total number of answers.

	Percent Correct Answers
Table 1	72%
Bar Chart 5	53%
Bar chart 6	66%
Bar Chart 1	46%

Table 7.3 – Percentage of correct answers in information recall

Finally, participants were asked some questions about several of the options in comparison to each other. In the first comparison participants were shown the Bright 2D option,

and the Image 2D option (Bar Chart 5 and 7 respectively). When asked which was easiest to read the dates on, Bar Chart 5 was almost unanimously chosen. As for which option made it easier to discern the totals, again, participants preferred Bar Chart 5.

	In which option are the dates easiest to read?	In which option are the totals easier to discern?
Bar Chart 5	49	41
Bar Chart 7	1	9

Table 7.4 – Comparison of 2D bar charts, bright colors and image

The next options presented, maintained the same color scheme so that the variation being tested was two dimensions versus three dimensions. Participants were asked which was more visually interesting and which option was easier to read. Totals are shown in Table 7.5.

	Which is more visually interesting?	Which is easier to read?
Bar Chart 3	10	47
Bar Chart 4	40	3

Table 7.5 – Comparison of muted color schemes, 2D and 3D

The next comparison compared two of the three dimensional options, the black and white and the image option. Participants were asked which was more visually pleasing and which allowed them to see that '78 was only reported for half a year. Table 7.6 shows the totals for each.

	Which option is more visually intriguing and/or pleasing	In which option is it easier to see that '78 is only for half a year?
Bar Chart 2	8	49
Bar Chart 8	42	1

Table 7.6 – Comparison of 3D options, black and white and image

The last comparison presented to the participants had them compare the table to the black and white two dimensional bar chart. Participants were asked which option presented the information in a more usable manner (easier to read/understand) and which was more visually interesting. Table 7.7 shows the totals for each option.

	Which option presents the information in the most usable manner (easiest to understand/read)?	In which option is it easier to see that '78 is only for half a year?
Bar Chart 1	24	42
Table 1	26	8

Table 7.7 – Comparison of B&W 2D to Table

Analysis

Analyzing the Likert scale rankings of the visuals, it becomes apparent that the same design principles from the previous experiments work best in visual design of bar charts as well. Participants preferred the two dimensional muted chart the most, but also highly preferred the bright colored options as well. To the point that the three dimensional version was preferred to that with muted tones. The black and white two dimensional option tested in the middle, but slightly less preferred than the visual with the image background. The three dimensional black and white option tested far lower than any other option. Figure 7.6 shows the preference visually.

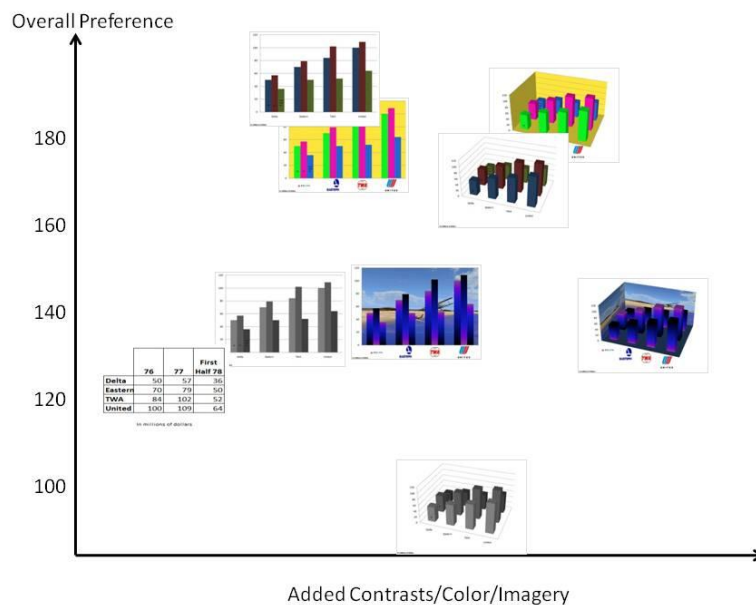


Figure 7.6 – Overall preference with reference to added contrasts/color/imagery

What this means is that people want visual interest in their displays, but they do not want so much that the information starts to play second fiddle to the information presented. Their needs to be a balance in the visual stimulation and the information presented. The Muted 2D bar chart uses colors as the indicative of which year the participant is using, there is minor variation in the color keeping the contrasts and plain text labels to a minimum. The Bright color options have slightly more contrast to the indicative colors, and add a yellow background for purely decorative purposes and corporate labels. This is fine, within the scope of the theory presented, because the colors are bright and fun which engaged the participant's interest.

In Figure 7.7, the results of the recall questions are shown in terms of the added contrast, color, and imagery. Generally, the results are consistent with the previous studies, “with the caveat that impressionistic evaluations may somewhat undervalue plain-table information, in terms of actual utility” (Alton & Manning, book chapter). What this means is, based on design features alone, tables will often be undervalued by the viewer, but in terms of information recall the table out scored the other options by at least 6%.

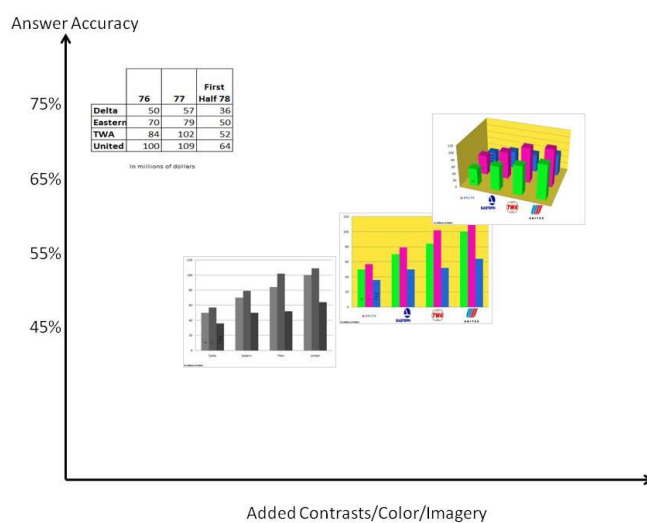


Figure 7.7 – Answer accuracy in reference to added color

It is interesting to note, that participants barely preferred a table over the black and white chart for useable presentation of information. Look back at Table 7.7, of the fifty participants 26 of them thought the Table presented the information in a more usable manner, while 24 thought the black and white bar chart was more usable. When it came to recall accuracy, the Table outperformed the black and white bar chart by 26%.

Chapter 8– PowerPoint Experiment

Like the previous experiments, this experiment investigated the use of color and images as decoratives and indicatives. It added in a short experiment on different methods for representing textual information. Taking Miller (1956) into account, several text slides were created using his three to four contrasts rule. The decorated PowerPoint slides were based on the following elements:

- Decorative elements such as color, font choices, border forms, and attractive imagery that creates an overall feeling.
- Indicative elements such as bullet points, white space, arrows, and thumbnail imagery, each calling visual attention to separate items in the menu.
- Informative elements consisting of the phrases and sentences, helpfully organized into structures such as tables to aid viewers in processing the information.

The purpose of this study was to determine the interaction of these elements, both in how they support each other and how they interfere with each other during information processing.

The first half of this experiment consisted of four different text options for the participants to read through. In Figure 8.1, the information was presented in a paragraph. Each detail of the text had its own sentence, making dividing it into bullet points easier for the rest of the experiments. The information presented was on childhood language acquisition of vocabulary.

Childhood Language Acquisition

From the minute children are born they begin their language acquisition. During the first two months children are in their reflexive vocalizations. These vocalizations are things like crying, fussing, coughing, burping, and sneezing. Between months two and four babies start to coo and their crying starts to decrease. At this point babies start to laugh more as well. During months four to six babies start engaging in vocal play. This stage is characterized by the appearance of very loud and very soft sounds. This is when children will learn to make "raspberries." At six months babies will respond to their names. They are also able to respond to human voices without visual cues, this is made manifest by turning their heads and eyes appropriately. They will respond to friendly and angry tones as well. Around twelve months children will use one or more words with meaning, this may not be full words quite yet, but they are used meaningfully. They will also be able to understand simple instructions, especially when vocal or physical cues are given. They will play around with non-sense words so that they can practice their inflection patterns. They are aware of the social value of speech and will try to engage you with their jargon-speech. By eighteen months, they will have a vocabulary of a five to twenty words, mainly nouns. They will repeat a word or phrase over and over and over again. Their jargon has increased at this point with increased emotional content. They are also able to follow simple commands.

Figure 8.1 – Text Option 1

The second variation added bulleted points for the participants to read through. Design manuals often suggest placing information on slides in a list fashion, highlighting the key information.

Figure 8.2 shows an example of a list of important facts.

Childhood Language Acquisition

- Babies start their acquisition from birth.
- Babies use reflexive vocalizations during the first two months.
- Reflexive vocalizations are things like crying, fussing, coughing, burping, and sneezing.
- Babies will decrease crying and start to laugh and coo between two and four months.
- Vocal play starts between months four and six.
- Vocal play is characterized by very loud and very soft sounds.
- "Raspberries" also develop during this phase.
- Babies learn their names and respond to them around six months.
- Human voices will engage the baby, which is evidenced by their heads and eyes turning towards the sound at six months.
- Babies also learn to respond to friendly and angry tones appropriately at six months.
- Children will use one or more words, with meaning, around their first year.
- Children will also be able to understand simple instructions, especially when vocal or physical cues are given.
- Children will play around with non-sense words so that they can practice their inflection patterns.
- Children are aware of the social value of speech and will try to engage you with their jargon-speech.
- Children will have a vocabulary of a five to twenty words, mainly nouns by eighteen months.
- Children will repeat a word or phrase over and over and over again at eighteen months.
- Children's jargon has increased at this point with increased emotional content.
- Kids are also able to follow simple commands at this point.

Figure 8.2 – Text Option 2

The third variation added a division of time to the bullet points, Here information was grouped into the categories "During Infant Stage" and "Beginning Toddler Stage." The point of this was to help the participant process the information on the page by grouping it into categories that the participants could use to process the amount of information. Figure 8.3 shows what this slide looked like.

Childhood Language Acquisition

During Infant Stage

- Babies start their acquisition from birth.
- Babies use reflexive vocalizations during the first two months.
 - Reflexive vocalizations are things like crying, fussing, coughing, burping, and sneezing.
- Babies will decrease crying and start to laugh and coo between two and four months.
- Vocal play starts between months four and six.
 - Vocal play is characterized by very loud and very soft sounds.
- “Raspberries” also develop during this phase.
- Babies learn their names and respond to them around six months.
- Human voices will engage the baby, which is evidenced by their heads and eyes turning towards the sound at six months.
- Babies also learn to respond to friendly and angry tones appropriately at six months.

Beginning Toddler Stage

- Children will use one or more words, with meaning, around their first year.
- Children will also be able to understand simple instructions, especially when vocal or physical cues are given.
- Children will play around with non-sense words so that they can practice their inflection patterns.
- Children are aware of the social value of speech and will try to engage you with their jargon-speech.
- Children will have a vocabulary of a five to twenty words, mainly nouns by eighteen months.
- Children will repeat a word or phrase over and over and over again at eighteen months.
- Children’s jargon has increased at this point with increased emotional content.
- Kids are also able to follow simple commands at this point.

Figure 8.3 – Text Option 3

In Figure 8.4, the fourth variation added even more divisions to the information, by increasing the amount of categories, according to design manuals; the participants will be able to better process the information. Design manuals use Miller (1956) as justification for taking a long list of information and “chunking” it into a more useable size. Four categories with 5 or fewer items will help viewers retain more information. Therefore, the information in variation four was divided into smaller units with these headings: “Babies: 0-4 Months;” “Babies: 4-6 Months;” “Toddlers” 12 Months;” and “Toddlers: 18 Months.”

Childhood Language Acquisition

Babies: 0-4 Months

- Babies start their acquisition from birth.
- Babies use reflexive vocalizations during the first two months.
 - Reflexive vocalizations are things like crying, fussing, coughing, burping, and sneezing.
- Babies will decrease crying and start to laugh and coo between two and four months.

Babies: 4-6 Months

- Vocal play starts between months four and six.
 - Vocal play is characterized by very loud and very soft sounds.
- “Raspberries” also develop during this phase.
- Babies learn their names and respond to them around six months.
- Human voices will engage the baby, which is evidenced by their heads and eyes turning towards the sound at six months.
- Babies also learn to respond to friendly and angry tones appropriately at six months.

Toddlers: 12 Months

- Children will use one or more words, with meaning.
- Children will also be able to understand simple instructions, especially when vocal or physical cues are given.
- Children will play around with non-sense words so that they can practice their inflection patterns.
- Children are aware of the social value of speech and will try to engage you with their jargon-speech.

Toddlers: 18 Months

- Children will have a vocabulary of a five to twenty words, mainly nouns.
- Children will repeat a word or phrase over and over and over again.
- Children’s jargon has increased at this point with increased emotional content.
- Kids are also able to follow simple commands at this point.

Figure 8.4 – Text Option 4

The second half of this experiment built on the last slide in the text option. Using the same basic structure, new information was added to the slides. This time the content focused on Semantic development in children. This process was divided into three sub categories: “Early

Words;” “Invented Words;” and “Unconventional Meanings.” In Figure 8.5, the first two options are presented. These were designed to mimic the decorative features of Menu 7 and 8 from the original study. In PowerPoint 1, primary colors were used with a variegated background. Decorative images were added to increase visual appeal; these images were themed to the topic at hand. PowerPoint 2 used brighter colors to try and draw attention to each category. The same decorative images were used as in PowerPoint 1.

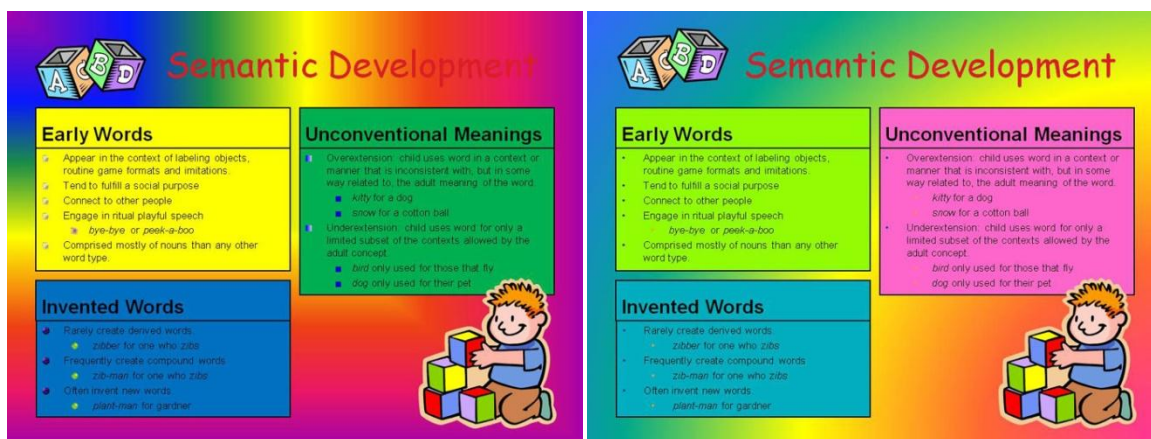


Figure 8.5 – PowerPoint 1 and PowerPoint 2

The second set of options focused on more subtle colors, and used indicative images to exemplify the different topics discussed on the slide. The design ideas, again, mimicked the Menu study, this time focusing in on Menu 5 and 6. Figure 8.6 shows thumbnails of each of the next two options. PowerPoint 3 used a green background with two different purple accent colors. These accent colors drew attention to the slide title and each topic heading. PowerPoint 4 used two shades of blue, one as the background, and a slightly lighter shade to highlight the slide title.

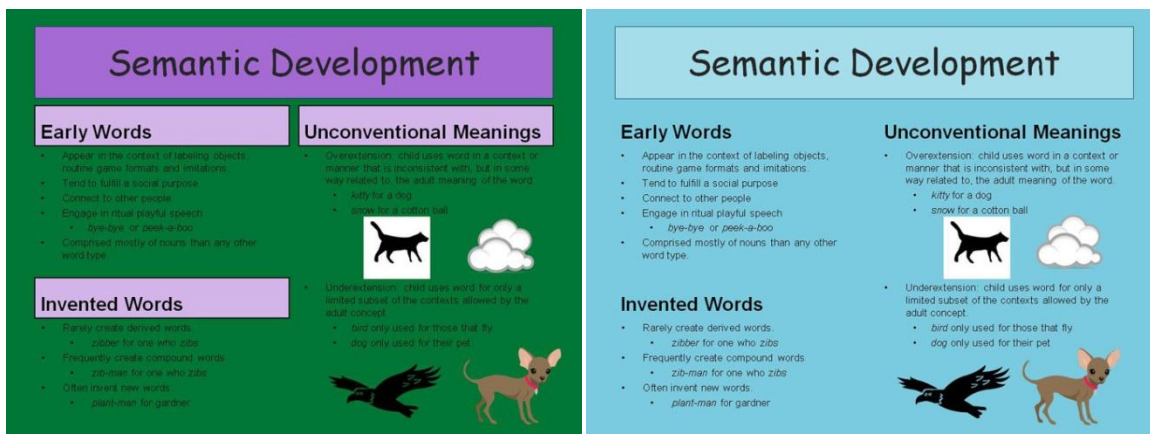


Figure 8.6 – PowerPoint 3 and PowerPoint 4

The final variations of this slide were based on Menu 1 and Menu 2 from the first study.

PowerPoint 5 used a cream background with red lettering to add visual interest to the black text and white background presented in PowerPoint 6. See Figure 8.7 for images of these slides.

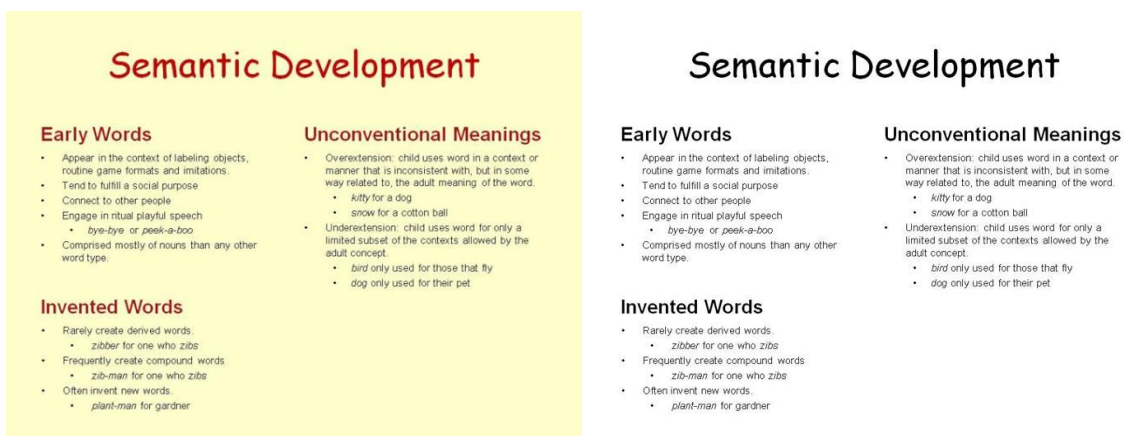


Figure 8.7 – PowerPoint 5 and PowerPoint 6

Methodology

This experiment resembled the first two experiments more than the third. Each participant was presented with one of four text options and asked to recall information from it. No Likert scale was presented in this portion of the study. The second half the of the study presented the participants with one of the six options on semantic development and then asked the participant to recall information from it. Participants were then asked to rank the designs on a the same Likert Scale as the previous experiments. The experiment was run with the aid of

Qualtrics online survey system

Participants

In this experiment forty-six participants were randomly selected to evaluate the PowerPoint slides. Their ages ranged from 19 to 63; with an average age of 37. Of the forty-six participants 40 were female and 6 were male. Of the participants 44 of them had at least some college, and 37 of them had graduated with a four year degree.

Survey

The questionnaire consisted of three background questions to gather data about the participants. Each participant was asked to record their age, and gender. Participants were also asked to record their education level.

After the background information the survey presented the participants with one of the four text images. Each option was followed with the same four questions.

- When do babies start to decrease crying and increase laughing?
- About how many words do children have at 18 months?
- Playing around with non-sense words is a way for children to practice their what?
- At what age do children know their names?

After the questions were answered, the participants were presented with one of six new slides.

The slides were followed with three questions based on the content of the presented slides. The questions were:

- Children rarely create this type of word.
- Early words tend to fulfill which purpose?
- “Bird” used only for birds that fly is an example of what?

Once participants had answered those questions, they were presented with all six options and asked to rank them individually on the same Likert Scale as used in the previous studies.

Procedure

Participants were asked to follow a link to the online survey. Participants were first presented with a consent form that they had to agree to before moving on to the rest of the survey. Participants were instructed to only examine the option for 1 minute after which they moved on to the question portion of the survey. The survey was set to not allow the participant to look back at the option while answering the questions. Once participants had answered all four questions, they were allowed to move on to the next part of the survey.

After participants completed the first questions and had recorded all their answers, they were presented with one of six new slides and they repeated the previous process. This time, when participants had answered the questions, there were presented with all six possible options and asked to rank them on a Likert Scale from one to five. The instructions asked them to rank them based on visual interest only.

Results

After the surveys were completed all the information was entered into a spread sheet. Each question was processed in a separate manner that fit the data collected. Each ranking in question one were compiled in a list form for each diagram. All the rankings were added together to determine the total amount of “points” awarded for each diagram. For example, if someone ranked PowerPoint 1 as “5 – Like It” then PowerPoint 1 was allotted 5 points for that response. Table 8.1 shows the total points per slide.

	Total Pts
PowerPoint 1	137
PowerPoint 2	173
PowerPoint 3	116
PowerPoint 4	169
PowerPoint 5	144
PowerPoint 6	123

Table 8.1 – Total Points per PowerPoint

This calculation shows the preference of each individual diagram. The next step for question one was to total each slide's total number of responses for each of the Likert Scale's options. Table 8.2 shows these rankings.

	1	2	3	4	5
PowerPoint 1	7	14	5	13	7
PowerPoint 2	0	7	9	18	12
PowerPoint 3	9	16	11	8	2
PowerPoint 4	2	7	8	16	13
PowerPoint 5	8	3	15	15	5
PowerPoint 6	11	6	19	7	3

Table 8.2 – Likert Scale rankings for each PowerPoint

What Table 8.2 is able to show, is how each diagram received the total points allotted by the participants. It is able to show the underlying preference patterns that Table 8.1 lacks.

The last thing that needs to be determined is how well the participants scored on the recall questions. In Table 8.3, the percent of correct answers are shown for each slide option. To calculate the percentages, the total number of correct answers were tabulated with reference to the visual presented. This number of total right answers was divided by the total number of answers. The resulting percentage is shown in Table 8.3.

	Percent Correct Answers
Text Option 1	73%
Text Option 2	63%
Text Option 3	33%
Text Option 4	50%
PowerPoint 1	69%
PowerPoint 2	50%
PowerPoint 3	50%
PowerPoint 4	42%
PowerPoint 5	56%
PowerPoint 6	50%

Table 8.3 – Percentage of correct answers in information recall

Analysis

Examining the answer accuracy of the text options, it shows that the paragraph form outperformed all the other options presented. Text Option 1 had a 73% accuracy rate, Text Option 2, with bullet points, scored 63% accuracy. When breaking the bullet points into subcategories, more is better. With only two divisions the accuracy dropped to 33% (Text Option 3), but it came back up when two more divisions were added to Text Option 4 (50%). Figure 8.8 shows this visually.

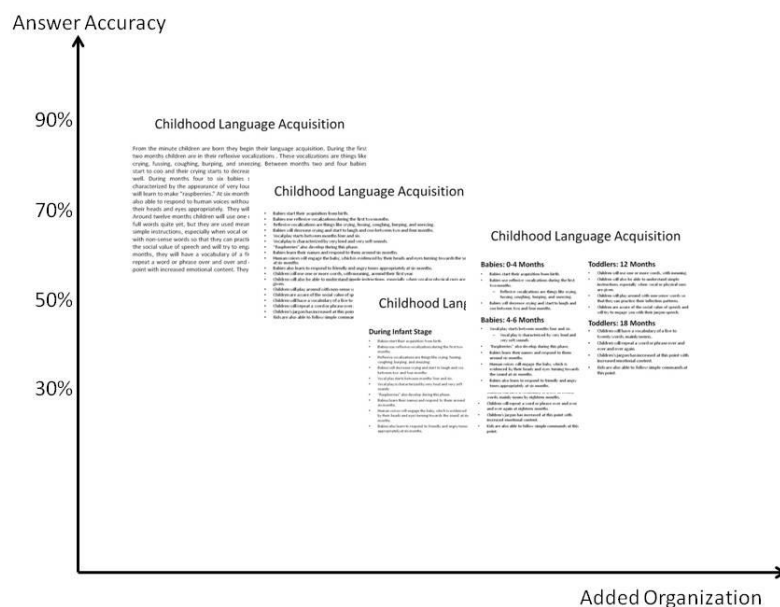


Figure 8.8 – Text Option Answer Accuracy

What this is showing us, is that people can get all the information they need, easily, from a text paragraph. But when distinctions are made, more may just be better. The difference in recall is minimal, and more testing is still needed. The problem with this experiment was caused by too many indicative distinctions. These distinctions created more work for the participants. The second problem that came up with this test included the misuse of headings. Propositional headings are better for memory retention than simple labels. Future work on this experiment would need to include propositional headings instead of simple labels and minimizing the indicative distinctions.

The next visual, Figure 8.9, shows the answer accuracy of participants based on added visual contrasts, imagery, and color to the presentations. PowerPoint 1 (69%) had the best answer accuracy recall, and PowerPoint 5 (56%) the second best. It seems odd, at first, that the option with only primary colors and decorative images would outscore options with more balanced color schemes and images that help exemplify the information. What this means is that, unlike

the menu test, this test was more focused on recalling information (secondness and thirdness); the menu test was based on feeling comfortable with ordering from the menu (firstness and secondness). There, the bright colors create the wrong feeling, here the brighter colors engage the viewer and help hold their interest.

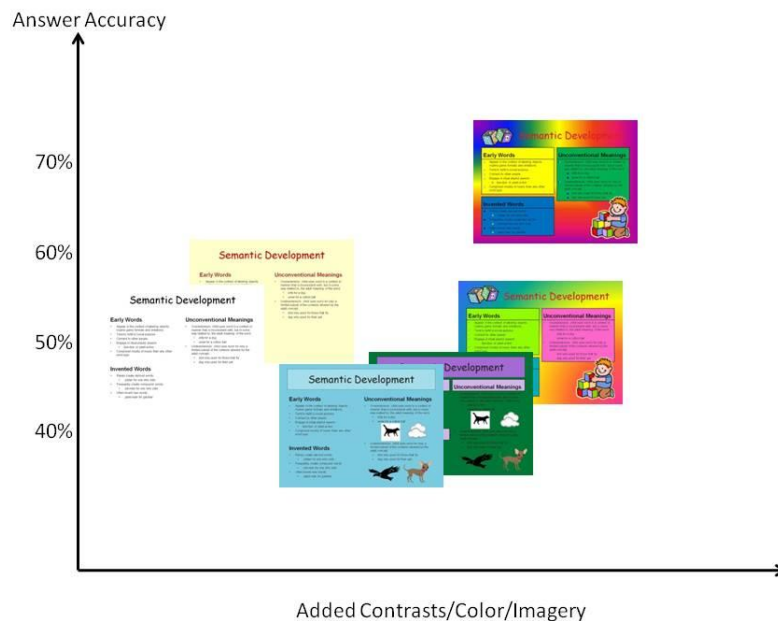


Figure 8.9 – Answer accuracy in reference to contrasts, color, imagery

Looking back at the Bug's Life experiment, there is a similar phenomenon there. The colors and imagery helped with participant retention instead of truly hindering it.

Participants were also asked to rank the options for visual preference. Here, the same patterns as before were found with one exception. This time PowerPoint 2 had the highest preference ranking at 173 points. This is expected due to the fun feel the colors give the design. The second most preferred design was predicted to be ranked higher by the participants. PowerPoint 4 pulled in 169 points. This design closely matched Menu 6, which tested as the optimal option.

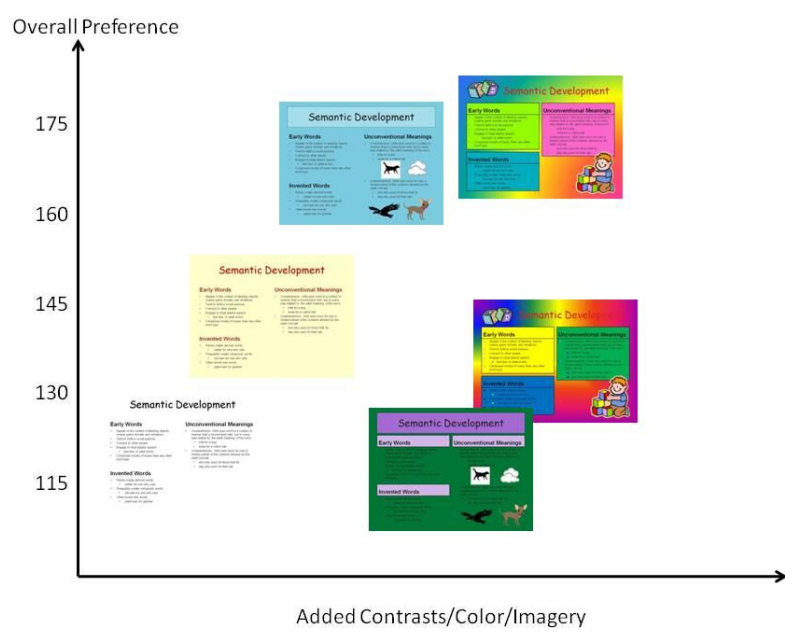


Figure 8.10 – Overall Preference of PowerPoint Design

PowerPoint 6, the black and white option, tested much lower than the Menu designed in the same fashion, this is because these are two different mediums. Menus that are black and white have an air of status to them, but a PowerPoint slide looks unfinished without any visual interest. Again, it's all about creating that balance and finding the tipping point.

Chapter 9 – Results

This chapter will discuss the results in terms of their references to Peircean theory and what that theory means for designers and editors of visual information. What the results will show is that in the Menu experiment, participants looked only at the leading edge of the design from decorative to indication. This meant that participants preferred unified decoratives with minimal contrast, and indicatives that did not over power the feeling of unity to the page. The next three experiments (diagrams, charts, and PowerPoints) moved participants away from the leading edge and into information structures where contrast and patterns are needed to aid information recall. Despite the need for contrasts participants will still prefer designs that have low contrast levels, but the data shows that participants did not retain as much information without the contrasts.

Menu Experiment

In this experiment participants were asked to ignore the information, as they would not be tested over it later. Participants were asked to look at the menu and determine which menu would be more preferable for them in a restaurant setting. This meant that they were left to gauge the level of unity in the decoratives and the indicative usefulness without the need of recall.

Not surprisingly, the participants chose Menus 2, 4, 6 as their top three favorites.



Figure 9.1 – Preferred Menus – Menus 2, 4, & 6 respectively

Menu 2 tested so well, because it was able to add a unified visual appeal, without adding any extra contrast than a plain black and white option. Menu 4 added a third element, indicative boxes to highlight the menu headings. This added the right amount of indicative contrast, without causing too much extra work on the part of the viewer. Still Menu 6 tested even better, thanks to added images that served as indicatives of the food offered. Placed on the triangle these menus would fall on the higher side of the leading edge as in Figure 9.2.

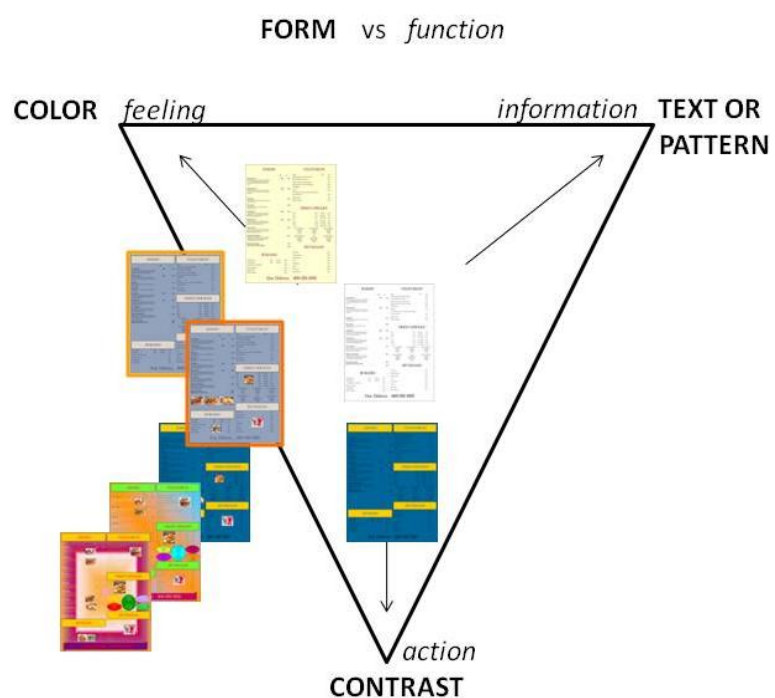


Figure 9.2 – Preferred menu in reference to Peircean Triangle
Viewer preferred: highlighted in orange; second preferred: lighter orange

In choosing which menus were the best designs, participants went with the menus that had the best unity in the theme and added just enough contrast to not interfere with the possible decision making process. Menus (7 and 8) that added contrast for the sake of decoratives tested much lower due to too many contrasts. Consider Menu 7, the background is made of two distinct colors, the headings have a third color, the boxes around the headings have a fourth color, and the bubbles surrounding each chicken dinner option have even more colors added in. Yet, it

tested better than Menu 8, why? The answer lies in the level on contrast of the decoratives and indicatives. Remember, Peircean theory tells us that decoratives and signaling indices basic forms are those of *quality of unity*. Meaning, these elements need to have a unified feel within their own spheres and with the items around them (for signaling indices). Menu 7 keeps to a theme of bright, “fun” colors, while Menu 8 has a range of colors that have no apparent connection to each other. This accounts for the lower scores.



Figure 9.3 – Menu 7 and 8

As for the last two menus in the experiment, Menu 3 and Menu 5, these find themselves having a similar, though less extreme, problem as Menu 8. Like Menus 2 and 6, only two colors were added to the menus, but they have a higher contrastive value than their preferred counterparts. This makes them less unified and therefore less likely to appeal to the viewers.



Figure 9.4 – Menus 3 and 5

Since viewers were only asked to predict which they would rather use in a restaurant, the visual appeal was their sole reaction. The results show that viewers want a visually unified decoration scheme that is not disrupted by the added indicatives.

Diagram Experiment

Moving away from pure perception, this experiment focused on how diagrams are affected by added visual elements. Here, participants were not only asked which the better option was visually, but they were tested on information recall. Diagrams, as stated in Chapter 4, are still meant to be unified and represent some real world item visually. In Figure 9.5, each of the diagrams tested is placed on the Peircean triangle for icons. The three versions of the diagram are placed according to their added visual appeal. This simple black and white drawing is used to represent a diagram that is the most “standard” form. When color was added to the diagram, no real indicative value was added with it. The contrasts added here were purely decorative.

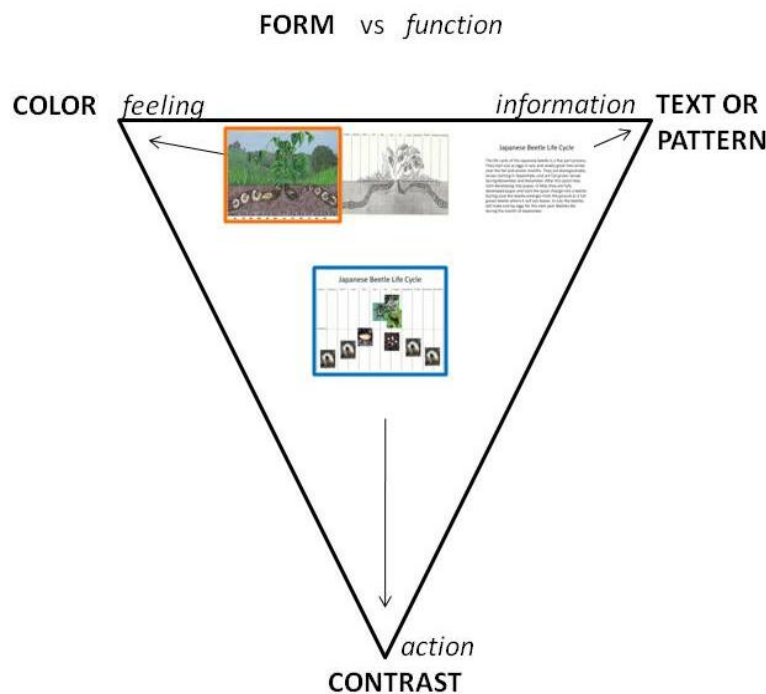


Figure 9.5 – Diagrams based on Peircean Analysis.

Viewer preferred: highlighted in orange; recall accuracy: highlighted in blue

However, when photographs were added to the diagram in lieu of the original drawings, indicative value was added by virtue of the images. Images necessarily point to the real world equivalent more than the hand drawn versions. In terms of visual preference, Bug’s Life 4 was

the preferred, this diagram offered visual interest without unnecessary contrast. As seen in the Menu experiment, unified themes with minimal contrasts are preferred to high amounts of contrast. However, recall from Chapter 6 that Bug's Life 1 with the images had the highest answer accuracy by about 10%. Higher contrast makes for better information retention. The contrasts are not indicative or decorative; the contrasts are meant to be informative. Viewers do not prefer this type of contrast aesthetically, but they do prefer it in terms of recall.

Bar Charts Experiment

Not surprisingly, the results here show the same pattern as the results in the Diagram experiment. Participants preferred minimal contrasts, or contrasts within a unified theme over contrasts that are purely decorative or no visual appeal. In terms of visual preference, participants chose Bar Chart 3 as the best design and chose Bar Chart 2 as their worst design.

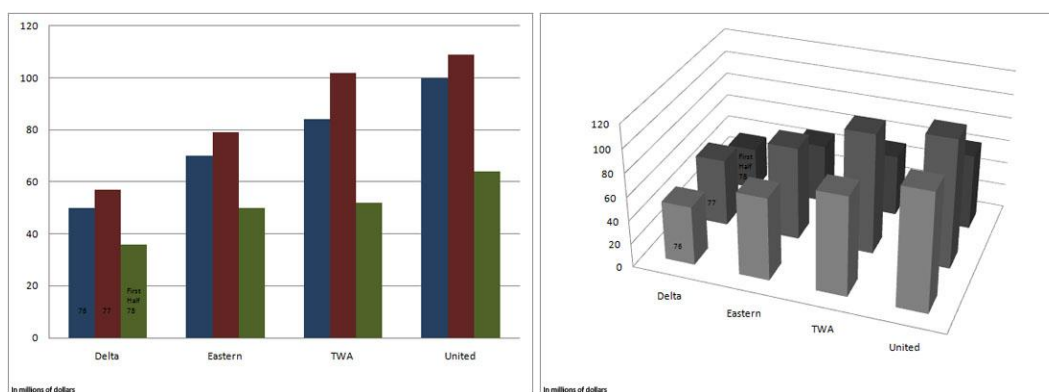


Figure 9.6 – Bar Chart 3 and Bar Chart 2

Bar Chart 3 offers enough indicative contrast with colors that viewers can easily see each year's commissions. Bar Chart 2, which offers a more unified, monochromatic theme, is not preferred because there is not enough difference to allow the participants to make distinctions.

In terms of recall, though, neither option tested as well as the Reference Index of the table.

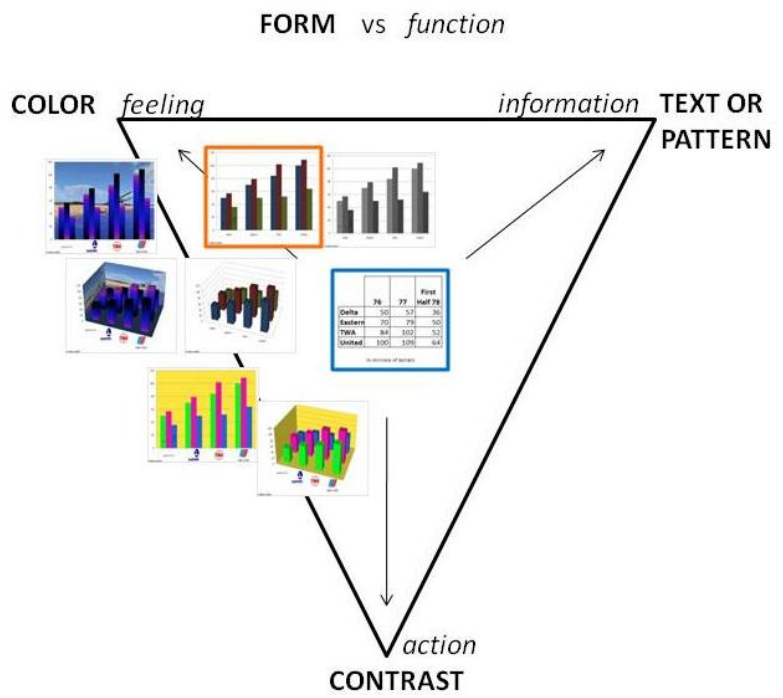


Figure 9.7 – Bar Charts vs. Tables on Peircean Triangle
 Viewer preferred: highlighted in orange; recall accuracy: highlighted in blue

The reason for this difference is that a bar chart’s different elements point only to themselves. In a table each cell is adjacent to another cell and therefore references those around them. Examine Figure 9.8. Look at the cell labeled “Delta;” naturally the viewer’s eye will move from that cell over to the cell on its right or down to the next cell with “Eastern.” This process continues until the whole table has been processed.

	76	77	First Half 78
Delta	50	57	36
Eastern	70	79	50
TWA	84	102	52
United	100	109	64

In millions of dollars

Figure 9.8 – Commissions Table

What this accomplishes, is a better synthesis of the information presented than can be given in a more iconic presentation. Viewers will not prefer the table visually, since it lacks decorations, but their retention rates show that the table is the preferred method for information.

PowerPoint Experiment

The first stage of this experiment looked at a whole-text-symbol option and various options that added signaling indices as a means of organization. After adding basic signaling indices, more order was imposed on the lists moving them towards a more referential index.

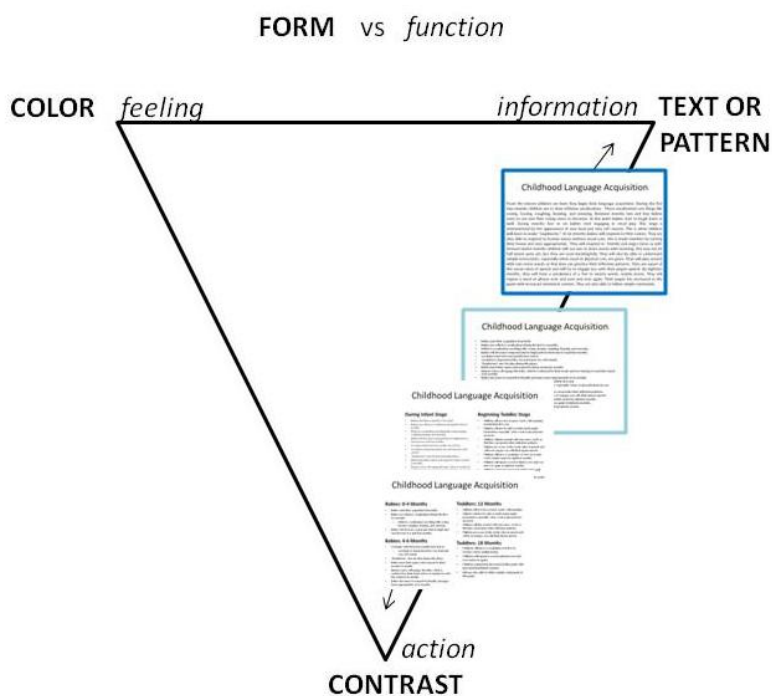


Figure 9.9 – Text-Only Options based on Peircean Analysis

High recall accuracy: highlighted in dark blue; second highest: highlighted in light blue

Information recall was best in the text-only option; this is because the point of whole-text-symbols is to inform. Recall the discussion in Chapter 4 on whole-text-symbols, each sentence relies on the other sentences for *proposition building*. When sentences are broken apart into a bulleted list, the sentences no longer build on each other, but are separate entities by themselves.

This adds unnecessary contrasts to the visual and the retention falls, some. Viewers do not tolerate indicative contrasts when they are not necessary.

Adding more divisions to the text only dropped scores more. This is due to the nature of the headings added. Each heading drew attention to the heading, but offered no propositional information. The headings were labels for the information below, which added distraction in the information recall. This suggests that instead of headings as labels, headings should contain complete propositions that are most important for the viewers to remember. This idea is in strict conflict with current design theory.

The second half of this experiment built on the last set of organization. The information was divided into categories and arranged on the page in a logical pattern (Referential Index). Then the same decorative features as used in the Menu experiment were applied to these PowerPoints. In this experiment, unlike the Menus, participants favored a fun theme over the more balanced theme. The difference between these two experiments, as mentioned in Chapter 8, is that the Menu experience only asked the participants to gauge their emotional response to the menu. In this experiment participants were being asked to move beyond raw perception, and move into information recall.

PowerPoint 2 was the visually preferred option due to its “fun” color scheme. The color choices that were meant to draw attention to the different stages were of similar feels creating a unity perception that viewers liked. PowerPoint 4 offered less indicative contrast, but added images that were meant to reinforce (signaling indices) the information being presented in the slide.

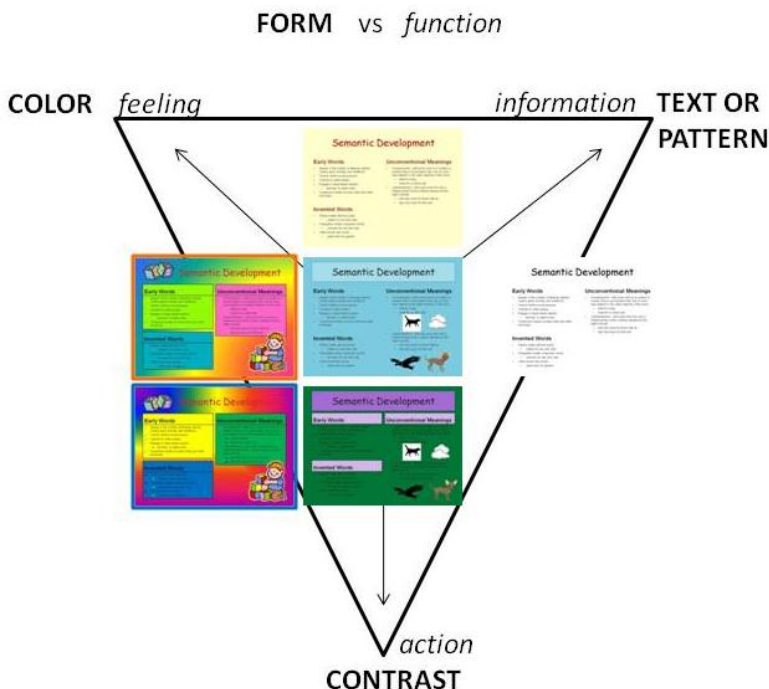


Figure 9.10 – PowerPoint slides based on Peircean Analysis
 Viewer preferred: highlighted in orange; recall accuracy: highlighted in blue

In terms of information recall, neither of these options tested as well as PowerPoint 1. This had the same number of colors as PowerPoint 2, but the colors in PowerPoint 1 helped the viewers retain more in their short term memory than those of PowerPoint 2.

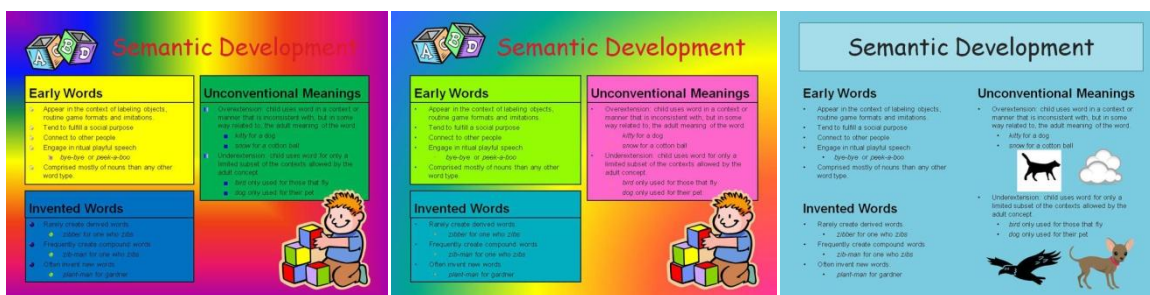


Figure 9.11 – PowerPoint 1, PowerPoint 2, PowerPoint 4

The colors here are slightly less contrastive than those in PowerPoint 2. Meaning the colors are able to serve their indicative purpose without overshadowing the text-symbols they are trying to draw attention to.

Chapter 10 – Conclusion

This thesis has presented data from four experiments that show quantitatively how balance can be achieved in information design. Initially, it was predicted that the research would show that the optimal preference would also have the highest recall accuracy; this was not the case.

Current design theory offers a lot of good advice on how to design good visuals, but they often contradict each other on some of the basic advice they give. The advice is usually general design principles that have been found to be good, but these principles allow room for interpretation. This lack of a concrete framework makes good design hard to replicate and hard to define.

This thesis proposed that applying Peirce's semiotic system to visual elements can correct some of the problems inherent in current design theory. The framework takes into account, and explains why some elements seem to have contradictory guidelines and explains the interactions of other design elements with each other. Color has two distinct functions, that of decoration and of indication. In tradition design manuals, authors try to bridge the gap between the two functions by creating general guidelines, Peircean semiotics allows for these two functions to operate independent of each other, while showing how they interact. Distinctions such as these could eventually help designers and editors create (and replicate) better designs with more consistency.

Experiment Review

The four experiments were created within the Peircean framework covered in Chapter 4. Each experiment was created to test for specific elements in reference to viewer preference and usability. Below each experiment is again explained in general terms.

1. **Menus** were used to test color use as decoration and as a means to direct attention. Pictures were also tested for their ability to decorate and direct attention.
2. **Diagrams** were used to test the use of images, both drawn and photographic, as information bearing units. Color was used in the drawn images to test for visual enhancement preference.
3. **Graphs** were used to test color as a decoration and as a means of directing attention. Color was contrasted with pictures as decorations.
4. **PowerPoints** were used to test text shape as a visual and as an information bearing method. Color and pictures were revisited in reference to its use as attention grabber and decoration.

The first experiment was able to show that when it comes to perception of aesthetics, viewers want simplified color schemes that did not interfere with the information being presented. The addition of a few indicative images were preferred over no indicative images, but only if those images did not get in the way of the information. The second experiment found that viewers retained more information when indicative contrasts were increased, but aesthetically speaking indicative contrasts were rejected by the viewers. The viewers preferred a more pleasing design of a drawn image of the beetle's life over the pictured option that had the higher retention rate. The third experiment tested retention of information from various bar charts or from a table. The table did test with a higher retention rate than any of the bar charts. This supports Tufte's (1983) claim that tables are better at presenting small sets of data over bar charts (56). The table was not the aesthetically preferred option; instead viewers preferred the bar chart with an unified color scheme. The last experiment found that solid text paragraphs can test better in memory retention, than bulleted lists. This experiment also found that decorative features that

are seen, by viewers, as fun can increase information retention because the viewer is more engaged in the overall design. But more unified designs are still preferred.

This means viewers who are seeking information want well designed visuals that have a unified theme that are simple with minimal contrasts. They would even prefer no decoration (black and white) over complex and contrastive decoratives. When contrasts are used for the sake of visual interest, the viewers are turned off to the visual. It is unappealing. However, contrasts used to show informative and indicative distinctions are well tolerated by viewers. The viewers will even prefer these indicative contrasts over a lack of contrast. When it comes to informative contrasts, viewers do not openly prefer them. Preference scores drop drastically when there are contrasts that are there for informative purposes. While they do not find these contrasts aesthetically pleasing, their retention scores increase when there are informative contrasts built in to the design. This distinction is important to remember: optimal viewer preference is different than optimal information recall.

Experiment Limitations

The menu experiment only asked viewers to gauge the usefulness of the menus based on their perception. This meant that their responses were purely speculative. This experiment utilized Likert Scales which do not take into account the participant's subjective evaluations of their own choices. However, participants were allowed space to comment on the designs, but many did not.

The diagram experiment had the same limitations as the menu experiment in regards to the use of Likert Scales. Here even fewer participants offered to explain their reasons for the rankings they had given the different options. There were also problems with the different

designs giving different information about the beetle's lives. The results did take this into account for answer accuracy scores.

Questions asked in the bar chart experiment seemed to favor the 3D option which allowed for easy access to the distinctions tested. This may account for the increased accuracy of this particular visual, when initial expectations would have placed it lower on the recall scale. Different questions may show different results. Future research would need to examine this possibility.

Information used in the PowerPoint presentation experiment may not lend itself well to list form. This could account for the lists not testing as well as the paragraph. Another possible limitation was in the design of the PowerPoint headings. Though phrasal headings are typical of PowerPoints, these headings do not help the viewers retain any factual information for the recall test. The implication is that phrasal headings become worse than white noise; they are now a distraction to the viewer. Propositional headings, on the other hand, could improve retention since they would include information that would be tested.

Implications

This is important for designers and editors to understand: when communicating information, the most aesthetically pleasing option is not always the most effective design. The end goal must take precedent over a beautiful display. Editors and designers should remember that keeping contrasts to a minimum in the decorations will help create the unified feeling that viewers want in a visual, but adding contrasts to the informatives or indicatives will aid the viewer in retention, and will be more visually pleasing than less complex visuals.

Design manuals give a lot of great advice for designers and editors; however, they offer no measuring stick to gauge the finished product. A Peircean model of design theory could give designers and editors a new tool they can use that allows them to interpret their goals in reference to the needs of the viewers; thus creating better designed information overall.

Future Work

More experimental work is needed with the Peircean framework as a tool to interpret the results. Future work should include pushing the limits of overloading the visual senses. The diagram and bar chart experiments started to push the limits of decoratives and indicatives, but never pushed them so far that the information was lost. To really gauge where these contrasts become problems, these limits need to be pushed farther.

Future work on text organization will also need to be conducted. As mentioned in Chapter 8, viewer's retention increased when the topic was sub-divided into more categories, but this added extra contrasts that fatigued the viewer. To truly test if these divisions are helpful, or detrimental, the experiment needs to be set up to decrease contrasts by dividing the information onto multiple slides, or something similar.

Another outlet for a future research would include having traditional graphic designers create designs based on their knowledge. Testing these traditional designs against ones created based on the Peircean framework would help to determine if Peirce's framework really can improve design quality overall.

The final option for future research would be to create a better cross section of participants. The current research was conducted with participants whose ages tended to range from twenty to thirty. There were not enough participants outside of this demographic to make

useful comparisons. Education levels were all relatively one dimensional as well. By creating a more representative participant pool, research could find that there are generational and educational preference differences in design.

What this thesis has shown is that common design rules-of-thumb are not consistently reliable in meeting the needs of viewers. Designers are given these rules-of-thumb to guide them in their design choices. Peircean theory shows where these rules-of-thumb are applicable and where they are not necessarily needed. The results of the experiments aid in these distinctions. The rules-of-thumb discussed below are not exhaustive; the rules discussed are ones which are clarified by both Peircean theory and results of this thesis.

It is believed that technical communication should always foster a positive emotional connection with the reader. However, as seen in Experiment 2, the diagram that allowed viewers to retain information better was the one that viewers liked the least. The diagram which had a positive emotional connection with the viewers tested lower on information recall.

Designers are told that they should write approximately 50% less when writing for the Web than for any other material. This is not necessarily the case. Recall Bergström's argument that if the text is engaging, the viewers will invest the time needed to read the document. In my fourth experiment, viewers had a higher retention rate from the text-only option, than from any of the "more organized" options presented.

The belief that the optimal number of steps in any procedure (or list) is seven plus or minus two has no real basis, even in the original Miller (1956) article or in current design. Miller tells us that if there is a long list of unrelated indicatives, the real threshold is closer to four;

however, Peircean theory allows that if there is a logical sequence to the list (a pattern) then it becomes a table and this allows for much longer lists because they are organized in a pattern.

Designers are encouraged to keep the language of bullet points to a maximum of six words. However, this is not necessarily good advice. As noted above, viewers are willing to invest the time in text if there is a reason for them to invest in it. This also goes back to the discussion on Miller's work. If the bulleted list is organized in a structured manner that makes sense to the viewer, they will read.

White space in text, designers are cautioned, makes the reader's attention wander. However, in the diagram experiment, it was the option with the most white space that allowed viewers to retain more information. This is due to the nature of white space as an indicative; if the white space calls adequate attention to what is next to it, then it fulfills its proper indicative function. White space is only a problem when it draws more attention to itself than the information next to it.

Finally, the last rule-of-thumb says that we cannot determine exactly why document design works, only that it does. The problem most design manuals have is that there is a pervasive lack of explanatory theory and no solid framework with which to evaluate design. This thesis has not only explained why many document designs work, but also how applying a Peircean analysis to visual design can give designer the framework needed to better understand good design.

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Appendix A – Informed Consent

Consent to be a Research Participant

Introduction:

This research is being conducted by Noël T. Alton a master's student of Brigham Young University's Linguistics Department and by Alan D. Manning a Professor in Brigham Young University's Linguistics Department. This research will determine the perceptions of different menu design options. You were randomly selected to participate in this study.

Procedure:

You will be asked to complete a short questionnaire about the menus presented. This questionnaire is made up of Lychert Scales, comparisons, and short response questions. This process will take no more than twenty (20) minutes to complete. Once completed participants will be free to go.

Instructions will be given to you both orally and on the questionnaire. If you have any questions, feel free to ask them at any point during the process.

Risks/Discomforts:

There are minimal risks/discomforts associated with this research for the participants.

Benefits:

There are no direct benefits to the participants. This research will offer a better understanding of how design principles benefit society.

Confidentiality:

All personal information will be kept private and will only be accessible by those doing the research in question. All responses will be presented as group data and will not be identifiable to anyone not affiliated with the research. During the research process all information will be kept in a locked filing cabinet for the space of 2 years. After this time personal information sheets will be shredded.

Compensation:

There will be no monetary compensation or extra credits given for participation.

Participation:

Participation in this research study is voluntary. You have the right to withdraw at anytime or refuse to participate entirely.

Questions Regarding Research:

If you have any questions regarding this research please feel free to contact Noël T. Alton at ntalton@gmail.com or Alan D. Manning at alan_manning@byu.edu.

Questions about your Rights as Research Participants

If you have questions regarding your rights as a research participant, you may contact Christopher Dromey, PhD, IRB Chair by phone at 422-6461; in person at 133 TLRB, Brigham Young University, Provo, UT 84602 or by email at Christopher_Dromey@byu.edu.

I have read, understood, and received a copy of the above consent and desire of my own free will to participate in this study.

Signature: _____ Date: _____

Appendix B – Menu Questionnaire

Participant Name:

Participant Age:

Participant Gender:

Education Level:

Favorite Restaurant:

1. Give your personal preference on each **individual** menu. These are to be done in isolation from each other and your preferences for one over the other should not be considered. Just rank each menu on a scale of 1-5, as defined below, individually.

Menu One:

1	2	3	4	5
Dislike it	Somewhat	No Opinion	Somewhat	Like It
	Dislike it		Like It	

Menu Two:

1	2	3	4	5
Dislike it	Somewhat	No Opinion	Somewhat	Like It
	Dislike it		Like It	

Menu Three:

1	2	3	4	5
Dislike it	Somewhat	No Opinion	Somewhat	Like It
	Dislike it		Like It	

Menu Four:

1	2	3	4	5
Dislike it	Somewhat	No Opinion	Somewhat	Like It
	Dislike it		Like It	

Menu Five:

1	2	3	4	5
Dislike it	Somewhat	No Opinion	Somewhat	Like It
	Dislike it		Like It	

Menu Six:

1	2	3	4	5
Dislike it	Somewhat	No Opinion	Somewhat	Like It
	Dislike it		Like It	

Menu Seven:

1	2	3	4	5
Dislike it	Somewhat	No Opinion	Somewhat	Like It
	Dislike it		Like It	

Menu Eight:

1	2	3	4	5
Dislike it	Somewhat	No Opinion	Somewhat	Like It
	Dislike it		Like It	

2. Just like at the eye doctor, I'm going to ask you to tell me which Menu you prefer in reference to another one. After Menu 1 & 2, and after Menu 5 & 6, you'll need to write in which you preferred for the next two combinations. For all: circle the one you prefer.

Menu 1	or	Menu 2
Menu ___	or	Menu 3
Menu ___	or	Menu 4
Menu 3	or	Menu 4
Menu 3	or	Menu 5
Menu 4	or	Menu 6
Menu 5	or	Menu 6

Menu __	or	Menu 7
Menu __	or	Menu 8
Menu 7	or	Menu 8

3. In the space provided below, you may comment on each menu. If there is one menu in particular that you like above the rest, this would be the place to tell the researcher. If there is something that you like, or don't like, about any of the menus in particular, this is the place to say it. These comments will help the researcher refine their design principles. You need not comment on all the menus if you do not wish to.

Menu One:

Menu Two:

Menu Three:

Menu Four:

Menu Five:

Menu Six:

Menu Seven:

Menu Eight:

Appendix C – Diagrams Questionnaire

BYU
BRIGHAM YOUNG
UNIVERSITY
DEPARTMENT OF
LINGUISTICS & ENGLISH
LANGUAGE

Participant Age

Participant Gender

Male

Female

Education Level

High School

Some College

College Graduate

Graduate Work

>>

BYU
BRIGHAM YOUNG
UNIVERSITY
DEPARTMENT OF
LINGUISTICS & ENGLISH
LANGUAGE

In what month do Japanese Beetles lay eggs? (Choose the best answer)

June

July

August

In what month do Japanese Beetles develop into full grown larva? (Choose the best answer)

December

April

June

In what month do the Japanese Beetles die? (This must be a month, no other answers are acceptable)

>>

Spending on the look of each only, please give your personal preference for each graphic. Do not rank them compared to each other for this question, they are to be considered individually.

Scroll up and look at each one as needed. Take your time, and consider your answer carefully.

	Dislike it	Somewhat Dislike It	Neither Dislike nor Like	Somewhat Like it	Like it
Option 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Option 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Option 3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Option 4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please rank the above options in order of usefulness in answering the given questions. 1 will be the most useful, 4 the least useful.

Option 1

Option 2

Option 3

Option 4

In the space provided below, you may comment on each option. If there is one option in particular that you like above the rest, this would be the place to tell the researcher. If there is something that you like, or don't like, about any of the options in particular, this is the place to say it. These comments will help the researcher refine their design principles. You need not comment on all the options if you do not wish to.

Option 1

Option 2

Option 3

Option 4



Appendix D – Bar Charts Questionnaire




Participant Age

Participant Gender

Male
 Female

Education Level

High School
 Some College
 College Graduate
 Graduate Work



In which year did United pay more in commissions?

76
 77
 78

In 78, which company paid more commissions?

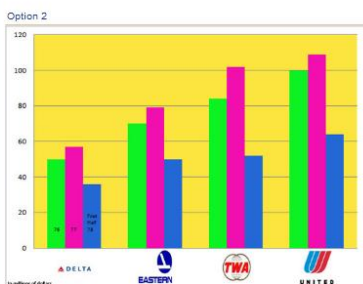
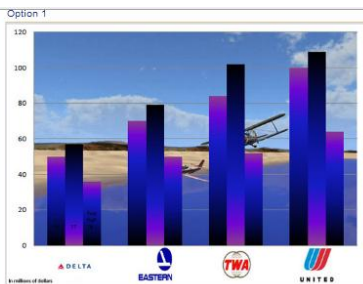
Eastern
 TWA

What accounts for the relatively lower amounts in the last year?

Competition among more travel agents.
 Commissions only reported for six months.
 Commission rates lowered by law in 1978.
 Unknown factors.

Which graphic option were you presented with initially?

A simple table
 Brightly colored 3D graph
 Brightly colored 2D graph
 Black and white 2D graph



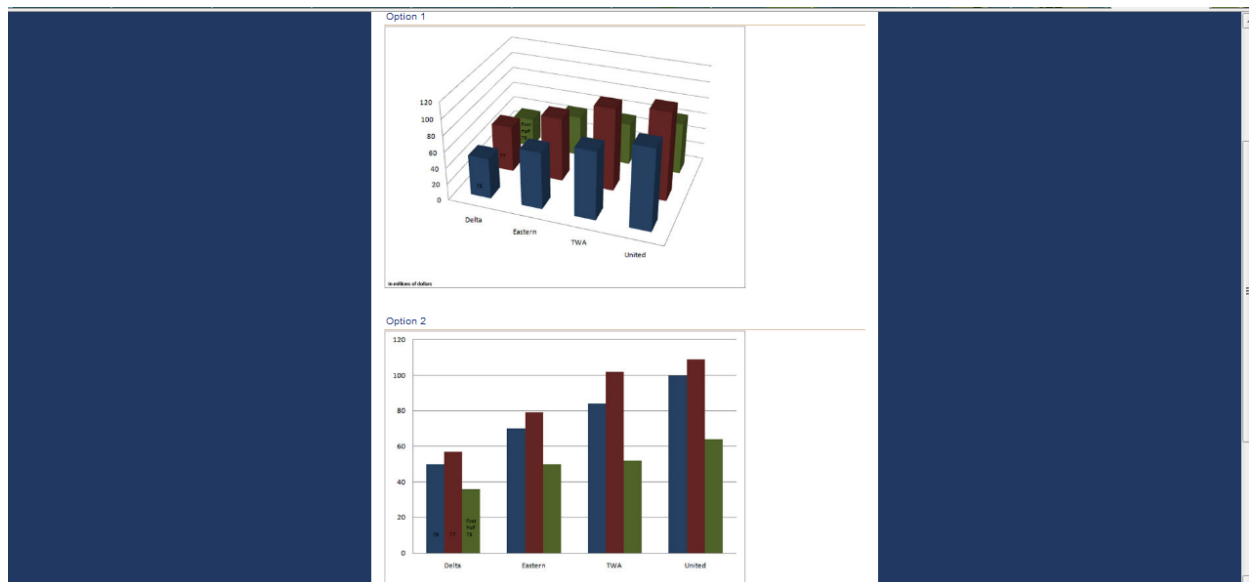
In which option are the dates easiest to read?

- Option 1
- Option 2

In which option are the totals easier to discern?

- Option 1
- Option 2





Which is more visually interesting?

Option 1

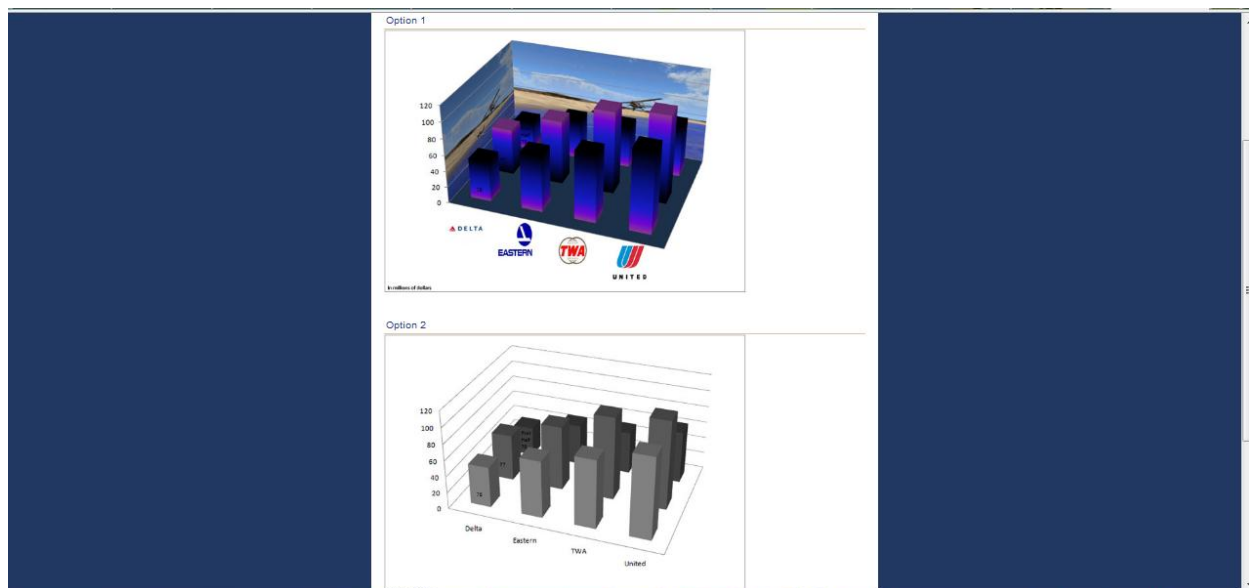
Option 2

Which is easier to read?

Option 1

Option 2

>>





Which option is more visually intriguing and/or pleasing

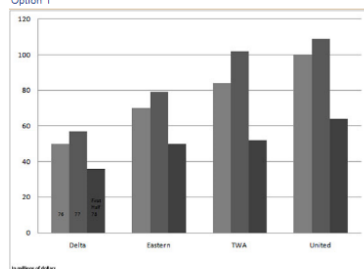
- Option 1
- Option 2

In which option is it easier to see that 78 is only for half a year?

- Option 1
- Option 2



Option 1



Option 2

	76	77	First Half 78
Delta	50	57	36
Eastern	70	79	50
TWA	84	102	52
United	100	109	64

In millions of dollars



Which option presents the information in the most usable manner (easiest to understand/read)?

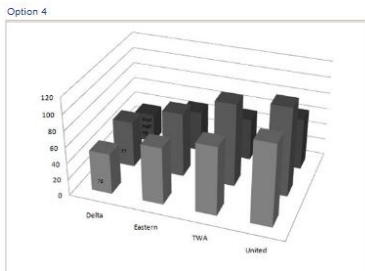
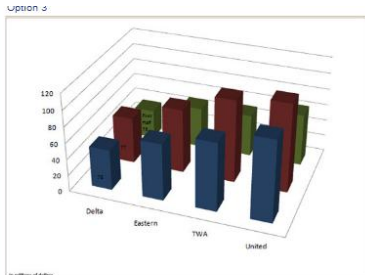
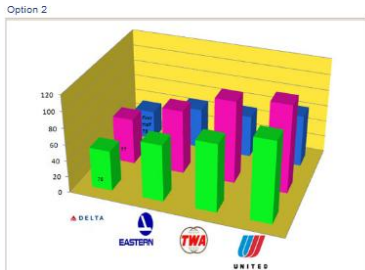
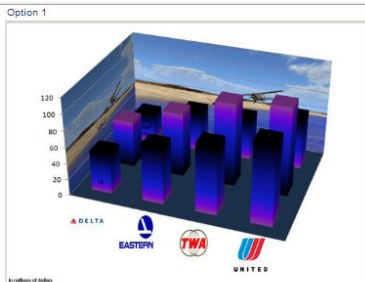
- Option 1
- Option 2

Which option is more visually interesting?

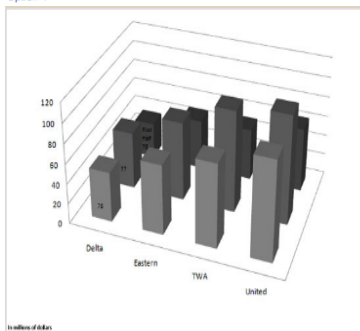
- Option 1
- Option 2



Follow Up



Option 4



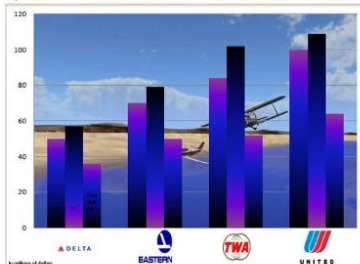
Speaking on the look of each only, please give your personal preference for each graphic. Do not rank them compared to each other for this question, they are to be considered individually.

Scroll up and look at each one as needed. Take your time, and consider your answer carefully.

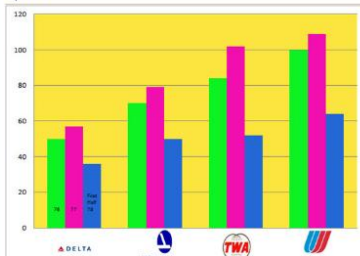
	Dislike it	Somewhat Dislike it	Neither Dislike nor Like	Somewhat Like it	Like it
Option 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Option 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Option 3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Option 4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



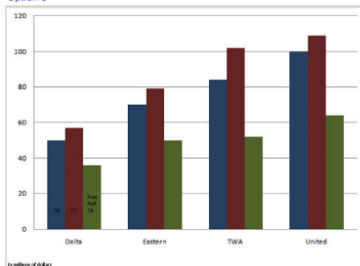
Option 1



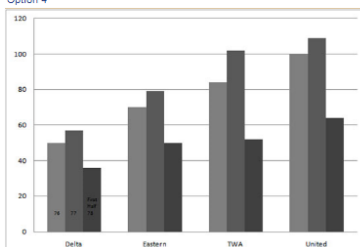
Option 2



Option 3



Option 4



Option 5

	76	77	First Half 78
Delta	50	57	36
Eastern	70	79	50
TWA	84	102	52
United	100	109	64

In millions of dollars

Speaking on the look of each only, please give your personal preference for each graphic. Do not rank them compared to each other for this question, they are to be considered individually.

Scroll up and look at each one as needed. Take your time, and consider your answer carefully.

	Dislike it	Somewhat Dislike it	Neither Dislike nor Like	Somewhat Like it	Like it
Option 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Option 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Option 3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Option 4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Option 5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



BYU
BRIGHAM YOUNG
UNIVERSITY

Participant Age

Participant Gender

Male

Female

Education Level

High School

Some College

College Graduate

Graduate Work

Appendix E – PowerPoint Questionnaire

BYU
BRIGHAM YOUNG
UNIVERSITY

DEPARTMENT OF
LINGUISTICS & ENGLISH
LANGUAGE

Participant Age

Participant Gender

Male

Female

Education Level

High School

Some College

College Graduate

Graduate Work

>>

When do babies start to decrease crying and increase laughing?

Two to Four Months

Two to Three Months

Five to Six Months

Three to Four Months

About how many words do children have at 18 months?

5-10

5-20

10-20

Playing around with non-sense words is a way for children to practice their what?

Intonation

Inflection

Communication skills

Turn Taking

At what age do children know their names?

4 Months

6 Months

8 Months

10 Months

>>

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DEPARTMENT OF
LINGUISTICS & ENGLISH
LANGUAGE

Children rarely create this type of word

Compound words
 Derived Words
 Invent words


Early words tend to fulfill which purpose?

Social
 Object labeling
 Connect to other people
 Ritual speech
 Information sharing

"Bird" used only for birds that fly is an example of what?

>>

Option 1



Semantic Development

Early Words


- 1. Appear in the context of labeling objects, routine game formats and imitations.
- 2. Tend to fulfill a social purpose
- 3. Connect to other people
- 4. Engage in ritual playful speech
 - bye-bye or peek-a-boo
- 5. Comprised mostly of nouns, than any other word type

Unconventional Meanings

- 1. Overextension: child uses word in a context or manner that is not included with, but is some- how related to, the adult meaning of the word
 - wiffy for a dog
 - stow for a cotton ball
- 2. Underextension: child uses word for only a limited subset of the contexts allowed by the adult context
 - bird only used for birds that fly
 - dog only used for their pet

Invented Words

- 1. Family creates derived words
 - zizzer for one who zips
- 2. Friends create neologisms words
 - schwan for one who oops
- 3. Children invent new words
 - pookinjer for garbage




Speaking on the look of each only, please give your personal preference for each graphic. Do not rank them compared to each other for this question, they are to be considered individually.

Scroll up and look at each one as needed. Take your time, and consider your answer carefully.

	Dislike It	Somewhat Dislike It	Neither Like nor Dislike It	Somewhat Like It	Like It
Option 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Option 2



Semantic Development

Early Words

- Appear in the context of labeling objects, routine game formats, and imitations
- Tend to fulfill a social purpose
- Connect to other people
- Engage in ritual playful speech
bye-bye or peek-a-boo
- Comprised mostly of nouns than any other word type

Unconventional Meanings

- Overextension: child uses word in a context or manner that is incongruent with, but in some way related to, the adult meaning of the word
 - kitty for a dog
 - snow for a cotton ball
- Underextension: child uses word for only a limited subset of the contexts allowed by the adult concept
 - bird only used for those that fly
 - dog only used for their pet

Invented Words

- Rarely create derived words
 - zibber for one who zibs
- Frequently create compound words
 - zib-man for one who zibs
- Often invent new words
 - plant-man for gardener



Speaking on the look of each only, please give your personal preference for each graphic. Do not rank them compared to each other for this question, they are to be considered individually.

Scroll up and look at each one as needed. Take your time, and consider your answer carefully.

	Dislike It	Somewhat Dislike It	Neither Like nor Dislike It	Somewhat Like It	Like It
Option 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Option 3

Semantic Development

Early Words


- Appear in the context of labeling objects, routine game formats, and imitations
- Tend to fulfill a social purpose
- Connect to other people
- Engage in ritual playful speech
bye-bye or peek-a-boo
- Comprised mostly of nouns than any other word type

Unconventional Meanings

- Overextension: child uses word in a context or manner that is incongruent with, but in some way related to, the adult meaning of the word
 - kitty for a dog
 - snow for a cotton ball
- Underextension: child uses word for only a limited subset of the contexts allowed by the adult concept
 - bird only used for those that fly
 - dog only used for their pet

Invented Words

- Rarely create derived words
 - zibber for one who zibs
- Frequently create compound words
 - zib-man for one who zibs
- Often invent new words
 - plant-man for gardener






Speaking on the look of each only, please give your personal preference for each graphic. Do not rank them compared to each other for this question, they are to be considered individually.

Scroll up and look at each one as needed. Take your time, and consider your answer carefully.

	Dislike It	Somewhat Dislike It	Neither Like nor Dislike It	Somewhat Like It	Like It
Option 3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Option 4

Semantic Development

Early Words

- Appear in the context of labeling objects, routine game formats and imitations.
- Tend to fulfill a social purpose
- Connect to other people
- Engage in ritual playful speech
 - bye-bye or peek-a-boo
- Comprised mostly of nouns than any other word type

Invented Words

- Rarely create derived words
 - zibber for one who zibs
- Frequently create compound words
 - zib-man for one who zibs
- Often invent new words
 - plant-man for gardner

Unconventional Meanings

- Overextension: child uses word in a context or manner that is inconsistent with, but in some way related to, the adult meaning of the word.
 - kitty for a dog
 - snow for a cotton ball



- Underextension: child uses word for only a limited subset of the contexts allowed by the adult concept.
 - bird only used for those that fly
 - dog only used for their pet



Speaking on the look of each only, please give your personal preference for each graphic. Do not rank them compared to each other for this question, they are to be considered individually.

Scroll up and look at each one as needed. Take your time, and consider your answer carefully.

	Dislike It	Somewhat Dislike It	Neither Like nor Dislike It	Somewhat Like It	Like It
Option 4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Option 5

Semantic Development

Early Words

- Appear in the context of labeling objects, routine game formats and imitations.
- Tend to fulfill a social purpose
- Connect to other people
- Engage in ritual playful speech
 - bye-bye or peek-a-boo
- Comprised mostly of nouns than any other word type

Invented Words

- Rarely create derived words
 - zibber for one who zibs
- Frequently create compound words
 - zib-man for one who zibs
- Often invent new words
 - plant-man for gardner

Unconventional Meanings

- Overextension: child uses word in a context or manner that is inconsistent with, but in some way related to, the adult meaning of the word.
 - kitty for a dog
 - snow for a cotton ball
- Underextension: child uses word for only a limited subset of the contexts allowed by the adult concept.
 - bird only used for those that fly
 - dog only used for their pet

Speaking on the look of each only, please give your personal preference for each graphic. Do not rank them compared to each other for this question, they are to be considered individually.

Scroll up and look at each one as needed. Take your time, and consider your answer carefully.

	Dislike It	Somewhat Dislike It	Neither Like nor Dislike It	Somewhat Like It	Like It
Option 5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Option 6

Semantic Development

Early Words

- Appear in the context of labeling objects, routine game formats and imitations.
- Tend to fulfill a social purpose
- Connect to other people
- Engage in ritual playful speech
 - bye-bye or peek-a-boo
- Comprised mostly of nouns than any other word type.

Invented Words

- Rarely create derived words
 - zibbar for one who zibe
- Frequently create compound words
 - zib-man for one who zibe
- Often invent new words
 - plant-man for gardner

Unconventional Meanings

- Overextension: child uses word in a context or manner that is inconsistent with, but in some way related to, the adult meaning of the word.
 - killy for a dog
 - snow for a cotton ball
- Underextension: child uses word for only a limited subset of the contexts allowed by the adult concept.
 - bird only used for those that fly
 - dog only used for their pet

Speaking on the look of each only, please give your personal preference for each graphic. Do not rank them compared to each other for this question, they are to be considered individually.

Scroll up and look at each one as needed. Take your time, and consider your answer carefully.

	Dislike it	Somewhat Dislike It	Neither Dislike nor Like	Somewhat Like it	Like it
Option 6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

»

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