Information Design of Public Documents: Applying Gestalt Principles to Improve User Understanding

Mémoire

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Résumé

La conception des documents publics joue un rôle important dans la manière dont l'utilisateur perçoit et comprend les informations importantes qu'ils véhiculent. De plus, la conception de tels documents peut avoir un impact important sur l'utilisateur en ce qui concerne sa confiance et son processus décisionnel. Les principes de design d'information peuvent apporter de précieuses perspectives sur comment les documents publics devraient être conçus pour qu'ils réalisent leurs objectifs. Cependant, le domaine du design d'information des documents publics souffre d'un manque important dans l'application de ces principes. D'autre part, les principes perceptuels de la Gestalt peuvent expliquer comment les humains organisent des éléments visuels en groupes et comment ils reconnaissent des patrons. Depuis leur introduction au début du XX^{e} siècle, les principes de la Gestalt ont servi à améliorer le processus visuo-perceptuel dans différents champs d'application (telles que la peinture, la sculpture, la création graphique et le design d'information). Dans ce mémoire, nous étudions l'application des principes de la Gestalt pour améliorer la compréhension de l'utilisateur des documents publics. Pour ce faire, en premier lieu, une méthode d'évaluation heuristique est adaptée pour identifier les problèmes d'utilisabilité dans les documents publics. Deuxièmement, une méthode d'analyse de documents, reposant sur des mesures des éléments visuels dans les documents, est proposée pour étudier l'application des principes de Gestalt, ainsi que les principes de conception graphique, dans les documents publics. Un échantillon de deux documents publics est utilisé pour démontrer et tester la méthodologie proposée. Sur la base des failles de conception identifiées par les deux méthodes susmentionnées, une approche minimale est proposée pour appliquer les principes de la Gestalt pour résoudre les problèmes identifiés. Les résultats obtenus montrent que l'application des principes de la Gestalt peut améliorer l'accessibilité et la compréhensibilité de l'information présentée dans les documents publics.

Abstract

The design of public documents plays an important role in user perception and understanding of the important information they contain. Moreover, the design of such documents can have an important impact on user self-confidence and decision making. The information design principles pertaining to how to visually structure and verbally construct documents to be easily well perceived and understood can provide valuable insights on how public documents should be designed and presented. Yet, in designing public documents there is a lack in applying the information design methods and frameworks. On the other hand, the Gestalt principles of perception can explain how humans organize visual elements into groups and how humans perceive and recognize patterns. Since their introduction in the early twentieth century, the Gestalt principles were examined and studied various times to improve the visual perceptual process in many application areas such as: painting, sculpture, graphic design and information design. Accordingly, this work studies the application of the Gestalt principles to improve the user understanding of public documents. To this end, first an adapted heuristic evaluation method is proposed to identify the usability problems of public documents. Secondly, based on precise measurements of the visual elements within the documents, a document analytics method is proposed to examine the application of the Gestalt principles as well as the design principles in public documents. A sample comprising two public documents is used to test and demonstrate the proposed methodology. Based on the design flaws detected by the aforementioned two methods, a minimal approach is adopted to apply the Gestalt principles to solve the identified problems. The results obtained show that the integration of the Gestalt principles in the design process can improve the accessibility of information in public documents and resolve many of the usability problems in these documents.

Keywords: document design, expert evaluation, Gestalt principles of perception, information design, public documents.

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Dedication

This master thesis is dedicated to my beloved family. *I love you all*.

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Introduction

Documents are essential in the daily activities of everyone. People use documents with the intention of communicating with one another, promoting services, building brands, raising awareness about important issues, and as a means of education as well. Moreover, people seek documents to find the information they want to help them solve their problems, achieve their goals, or to purchase services or products. Accordingly, documents should be designed to help readers easily access the information they need and to better accomplish their tasks (Lipton, 2007). Documents can be categorized as confidential, private or public documents. While public documents are the most used among these types of documents, the majority of public documents are challenging to understand and use. The complexity existing in public documents could exceedingly affect user's perception and cognition (Schriver, 1997). This complexity is due to the fact that the knowledge regarding designing public documents is not well developed, where there is a lack in methods and guidelines that could assist designers in designing public documents. Hence, understanding document design and applying the right principles could contribute in improving readers' understandings of public documents.

A good understanding of what could be improved in public documents can be a good approach towards designing better quality, more effective and user friendly public documents. To this end, information design and the Gestalt principles are key to a successful design of public documents. Information design is the field concerned with transforming complex information to simple and understandable information. It encompasses all the fundamentals needed to reach the optimal information product for the user, including the sponsoring organization goals as well as the user's needs and expectations. The Gestalt principles of perception describe how the human minds perceive and observe visual elements. These principles could have an insightful influence on the meaning of presented information. Moreover, the Gestalt principles can have a big impact on document design (Hawkins & Kimball, 2008). Meaning that, applying Gestalt visual principles on any document could improve its intricacy, which could reflect on the reader's comprehension and perception leading to improving the user experience and understanding of public documents.

Chapter 1
Problem statement

1.1 Research problem

Every government, organization, business and product has a certain document that it utilizes to communicate its services or product's information. Examples of these documents include health care benefits agreements, insurance policies, product catalogs, and installation, operation and service manuals. The objective of all these documents is to increase their reader's knowledge. Hence, the information in these documents should be designed to meet reader's needs and expectations in regards to visibility and comprehension. As such, when readers use a document to find a certain information, they expect to find this information in a short time and more importantly they expect to find it expressed in a form that they can easily understand. Moreover, every time readers access the information in a document there is a chance for them to either get engaged by the document they are using, or to get disengaged from it. Which of these sentiments the readers get depends on how the document is being designed and visually structured.

Documents may be categorized based on their intended audience as either private documents (e.g., letters, diaries, personal e-mails etc.) or public documents (e.g., tax forms, birth forms, renewal forms, flyers, brochures, posters, etc.). Public documents have a big impact on their reader's decision-making and cognitive load. In order to have a public document achieve its goal, the document's design has to be easy to access, read and understand. Thus, designing the information in public documents entails making very precise and concise decisions about the goal of the document and the audience to whom the document will be presented (Stadler & Land, 2007).

Nevertheless, not all public documents are easy to understand, nor are they suitable for widespread use by the public. Public documents are mostly uneasy, difficult to understand and inconvenient to use (Sless, 2004). While the original intention of public documents is to communicate information to the readers without an intermediary, many readers find it imperative to seek human assistance in order for them to navigate and understand the information they are looking for in these documents. The level of complexity that exists in the public documents, could also lead to inconveniences for both the organization producing (or sponsoring) these documents, and the readers of the documents. As a result, people may end up either getting discouraged from the product or the service, or making wrong decisions.

There is no doubt that a poorly designed document could affect its reader's thinking and attitudes. Two studies done by Shriver (1997) showed that a poorly designed document can have a negative

impact on the reader's self-perception, and can cause cognitive problems. Shriver also mentioned how design can affect people's thinking and beliefs, and their ability to use texts and technology. In the first study, it is shown how people assign blame when they are not able to use texts or products (1997: 211). The second study examines how poor design can cause cognitive problems for readers (1997: 246). Another study was done in Australia on the public information documents distributed by the Australian public sector and has shown that despite the fact that the documents were designed for the public, the majority of the participants in the study have found the documents difficult to navigate and understand (Black, Luna, Lund, & Walker, 2017).

In order to overcome this issue first, it is important to consider that both a good writing and a good visual design have the potential to make a difference. Therefore, it is important to: 1) visibly structure the document to catch the main idea, and 2) use both visual and verbal languages to connect the reader to the document. In other words, for the communication between the document and the reader to be fully successful, it is essential to consider not only the written language of the document which means how the text is being written, but also the visual elements such as the typeface, headings, background and margins (Delin, Bateman, & Allen, 2002), as all of these elements contribute to how the document will be delivered to the reader, and how effective the document will be at the end. Second, it is essential to understand how readers perceive and understand documents, in order to inform the design process. It is important to be aware of how human beings read and how documents should be structured to assist an effective information processing. As Schriver (1997) puts it, the comprehension regarding creating public documents is not well developed. In other words, there is an unavailability of methods based on scientific understanding of visual attention and pattern perception that could assist designers in designing public documents. Being aware of these issues could enhance the design process for document designers, which in turn will help them create effective documents that speaks to the readers and get them engaged.

There is a lack of awareness and skills in using suitable methods and strategies in designing public documents. Moreover, there are many factors that could affect the usability of a public document. In some cases, the lack of communication between the text composer, the graphic designer, the editor and the illustrator, can lead to a poorly designed document (Schriver, 1997). In other cases, it is the lack of using design principles in designing the document's layout. In fact, design principles are not only meant for æsthetic or artistic purposes, but more importantly to achieve the reader's goal and objective from the document. Hence, there is a need to apply specific design principles when designing public documents. Principles that support reader's cognition, perception and improve the

performance of receiving messages through an effective document. Such principles could be used to emphasize important information for instance, or de-emphasis irrelevant information. A study was done on a document of few pages that provides train operators of the Italian railway company with data about the engine and traction characteristics they are using. In this study, methodologies from the fields of document design and human-computer interaction were adopted to analyze and redesign the document. Results from applying both types of methodologies showed a constructive results and improved the visual display of the document under consideration (Torsi, Rizzo, Pozzi, & Save, 2002).

For readers to be engaged by any document, they have to read it first, and for them to decide to read it the document has to contain the required elements of attractiveness (Sless, 2004). Accordingly, no matter how important the information is, if it is not well-designed and delivered, then it will have less impact on the readers. A well-designed document optimizes the visual thinking process, improve user's cognition and comprehension, and can lead to cost savings, productivity improvements and reader's satisfaction. On the other hand, a badly-designed document could influence not only the way people think, and feel, but also their attitudes towards the document and the organization behind it (Schriver, 1997).

Furthermore, it is also important to urge design students to practice developing written information with visual features to increase their ability to produce better and comprehensible information for the audience (Bernhardt, 1992). They should be aware of what the market needs of their clients and provide the readers with the material that respects their needs, values and help them achieve their goals. Learning the design principles will contribute in enhancing the design of the documents presented by the organizations and will add more value to the the role of design in communicating technical communication (Markel & Wilson, 1996).

Visual artists, designers and visual communicators have been employing certain theories that have helped them in developing documents that effectively communicate to its readers, theories based on scientific understanding of visual attention and pattern perception that could assist designers in designing public documents. These theories are called the Gestalt principles of perception. The Gestalt theory has an insightful influence on the meaning of presented information (Graham, 2008). Gestalt has a big impact on document design (Hawkins & Kimball, 2008). Thus, applying Gestalt visual principles on a public document could improve its intricacy, which reflect on the reader's comprehension and perception. Additionally, applying these principles could raise reader's awareness towards the information presented in public documents and can help readers be less frustrated, more responsive and accomplish more of their goals.

1.2 Research objectives

Gestalt principles of perception have big impact on how readers perceive and view visual communications. Motivated by several previous applications of the Gestalt principles of perception in enhancing the design of information in different domains, the main objective of this research is to emphasis the impact of the Gestalt principles of perception in reducing complexity and creating effective public documents.

The specific objectives of this research are outlined as follows:

1. Understanding the role of Gestalt principles in the usability of public documents.
2. Analyzing the Gestalt principles and its impact on public documents layout.
3. Identifying which of the Gestalt principles are or could be integrated in the design of public documents and which principles are difficult to integrate in the design process.

1.3 Thesis layout

The remainder of this thesis is structured as follows:

Chapter two presents a necessary background and a literature survey on information design, followed by an information design model. The proposed information design model incorporates the essential elements and phases to achieve the ultimate goal of information design which is attaining the goals of the users.

Chapter three presents the history of the Gestalt principles of perception, following by a description for each of these principles as well as an example of its application. This chapter also provides a literature review of the applications of the Gestalt principles in different fields and in document design.

Chapter four presents the selected documents and the proposed methodology to achieve the objectives of this study. The proposed methodology employ two main methods: 1) expert evaluation method 2) the document analytics method with the use of the Gestalt principles.

Chapter five presents the results and the analysis for the application of the expert evaluation and document analytic methods on the selected documents. Moreover, redesigned versions of the selected documents after applying certain Gestalt principles are developed in order to examine the impact those principles have on improving users understanding of public documents.

Chapter 2
Information design

2.1 Introduction to information design

The special interest group on information design (STC) was founded in 1997. In the first three years after its inception, this group was joined by more than 2,700 members (Redish, 2000). At that time, despite the big interest shown in this group, the term *information design* was not given a clear and concise definition. This was mainly because information design was a multidisciplinary field arising from different domains such as ergonomics, linguistics, human factors and cognitive psychology, sociology, anthropology, graphic design and computer science (Frascara, 2015). Tufte (1990) has noted earlier that the term *information design* was first used to describe the æsthetic graphic design of information resources (Zimmermann, 1997). However, the term *information design* was broaden later to encompass the development of a document or a communication, including: 1) the overall process of developing a successful document, and 2) the way the information is presented on a page or a screen (layout, typography, color, and so forth) (Redish, 2000).

Since the 1990s, many authors and researchers have attempted to define the term *information design*. Nevertheless, as information deign can be viewed from many perspectives and from the vantage point of different disciplines, a unified and clear definition of information design is yet to be found (Pettersson, 2002). Table 2.1 outlines some of the important definitions that were given to information design by different authors and researchers over the past three decades. The analysis and study of these definitions show that most of the authors and researchers in the field agree that information design is mainly concerned with the content of the message, its visual presentation, and how its conveyed to the user. Moreover, it can also be noticed that there are common factors that the majority of the researchers and authors have settled on, and are associated with the definition of information design. These factors include users, cognition, perception, understanding, efficiency and effectiveness. These important factors have added a big value to information design and makes it different from other kinds of design in regards to the communication purpose (Pettersson, 2002).

Some authors and researchers have related information design with complex information, and how to transfer it in a simple way so that users can understand it. However, it can be argued that the information does not have to be complex or difficult for the information design process to be of importance. Some information, signs or messages may be simple by themselves, nevertheless, the way they are formed and designed can make it difficult for the user to understand them, or it could just take more time than it should for the user to understand them, which does not achieve the

objectives of information design. Accordingly, the purpose of information design is not just transferring complex information to information that is easy to understand, but it is rather to convey information to the user (Katz, 2012).

Table 2.1: Definitions of Information Design

Author/Researcher	Definition	Source
Phil Fisher, and David Sless	Information design is concerned with the accessibility and the usability of information to users.	(Fisher & Sless, 1990)
Clement Mok	Information design is the arrangement of organization models to provide context and meaning for the information.	(Mok, 1996)
Beverly B. Zimmerman	Information design is the theory and practice of presenting information in a comprehensive, usable, and effective manner.	(Zimmermann, 1997)
Robert E. Horn	Information design is defined as the art and science of preparing information so that it can be used by human beings with efficiency and effectiveness.	(Jacobson, 1999)
Saul Carliner	Information design is preparing communication products so that they achieve the performance objectives established for them.	(Carliner, 2000)
Janice C. Redish	Information design is what we do to develop a document (or communication) that works for its users.	(Redish, 2000)
Lidman and Lund	Information design is what makes the message easy for the reader to receive and understand and is the advantages of having an informative layout, where words, pictures and graphic design work together to form this message.	(Pettersson, 2002)
Christine Sevilla	Information design is about communication that makes complex clear. It is often described as the effort to organize the pattern in data to create meaningful information and a path of understanding	(Sevilla, 2002)
Rune Pettersson	Information design comprises the analysis, planning, presentation and understanding of a message, its content, language and form. Regardless of the selected medium, well designed information set, with its message, will satisfy	(Pettersson, 2002)

	æsthetics, economic, ergonomic, as well as receiver and subject matter requirements.	
Dino Karabeg	Information design is the design of information.	(Karabeg, 2002)
International Institute of Information Design	Information design is defining, planning, and shaping of the contents of message and the environments it is presented in with the intention of achieving particular objectives in relation to the needs of the users.	(Pettersson, 2002)
Frank Thissen	Information design is about the clear and effective presentation of information. It involves a multi and interdisciplinary approach to communication, combining skills from graphic design, technical and non-technical authoring, psychology, communication theory, and culture studies.	(O'Grady, 2008)
Gerlinde Schuller	Information design is the transfer of complex data, for the most part, two-dimensional visual representation that aim at communicating, documenting and preserving knowledge. It deals with making entire sets of facts and their interrelations comprehensible, with the objective of creating transparency and eliminating uncertainty.	(O'Grady, 2008)
Jesse James Garrett	Information design is making decisions about how to present information so that people can use it or understand it more easily.	(Garrett, 2010)
The Society of Technical Communication	Information design is translating of complex, unorganized, or unstructured data into valuable, meaningful information	(Baer, 2010)
Ronnie Lipton	Information design is the study and practice of bringing clarity and comprehensibility to visual material that are meant to direct, teach, explain, or otherwise inform.	(Lipton, 2011)
Karen Shriver	Information design is the art and science of integrating writing and design, so that people can use content in ways that suit their personal goals.	(Schriver, 2013)

Lidman and Lund (1972) (as cited in Pettersson, 2002) explained that what makes the message easy for the reader to receive and understand is the advantages of having an informative layout, where words, pictures and graphic design work together to form this message and that this is mainly the

goal of information design. Nevertheless, Carliner (2000), in explaining his definition of information design, mentioned that the information design has a broader focus which encompass not only the layout of the document (which includes text, graphics and the goal of the user), but also the realisation of the goal of the sponsor who ordered the document in the first place (Carliner, 2000). As such, the document sponsor seeks user's confidence, trust and recognition by producing quality products and information to them, and the information design pursues this by attempting to create a clear and effective communication through quality information designed product to be presented to the user.

A related point to consider is that there is a difference between an informative layout which is also called *lexi-visual layout* and an artistic layout. The informative layout is when all the elements in the layout work together to form a message that is clear and understandable to the user. On the other hand, an artistic layout has no purpose to serve except to please the recipient or the graphic designer himself (Pettersson, 2002). The main importance of information design lies in helping the user understands and perceives the information. Thus, it requires always an informative layout as it transfers information into more accessible and acceptable form through effective management, to improve the performance of receiving messages (Ouyang, Cheng, & Yan, 2012). As Sless stated, "information design can be used to enhance the public communication and can be used as a basis for institutionalizing good public communication" (2008: 251). Moreover, delivering the right information clearly and comprehensibly is the goal of information design (Hawkins & Kimball, 2008).

Hence, based on the aforementioned definitions and analysis, we can propose a definition that covers almost all the important factors and aspects of information design: ***Information design is the theory of presenting information in a way that is visually structured, and verbally constructed to assist the user in navigating, perceiving and understanding what he/she is looking for without being frustrated and/or requiring any assistance.***

Figure 2.1 shows an illustration of a proposed information model as well as its essential process to achieve its main objective. First it starts with part one (the theoretical part) which include two elements to study; 1) understanding user's cognition and perception, and 2) understanding organization's goal, or the sponsor, to which the presented product or information belongs to. Next, it comes the needs and the expectations for the design product which are anticipated and defined in light of the user's cognition and the organization's goal, as identified in the preceding step. Second, comes part two: (the practical part) which designates the presentation of the information design product. It comprises the visual presentation of the information design product, meaning the use of

the organization's content with the application of lexi-visual representation (text-photos-graphics), to well establish the design of the information. The visual presentation that should be accomplished in this part is producing a design product that should be (accessible- comprehensible- usable), so as to be successfully delivered for the user to achieve his/her goal. For the last task, usability testing is usually applicable to assess if the information design product meets the criteria or not.

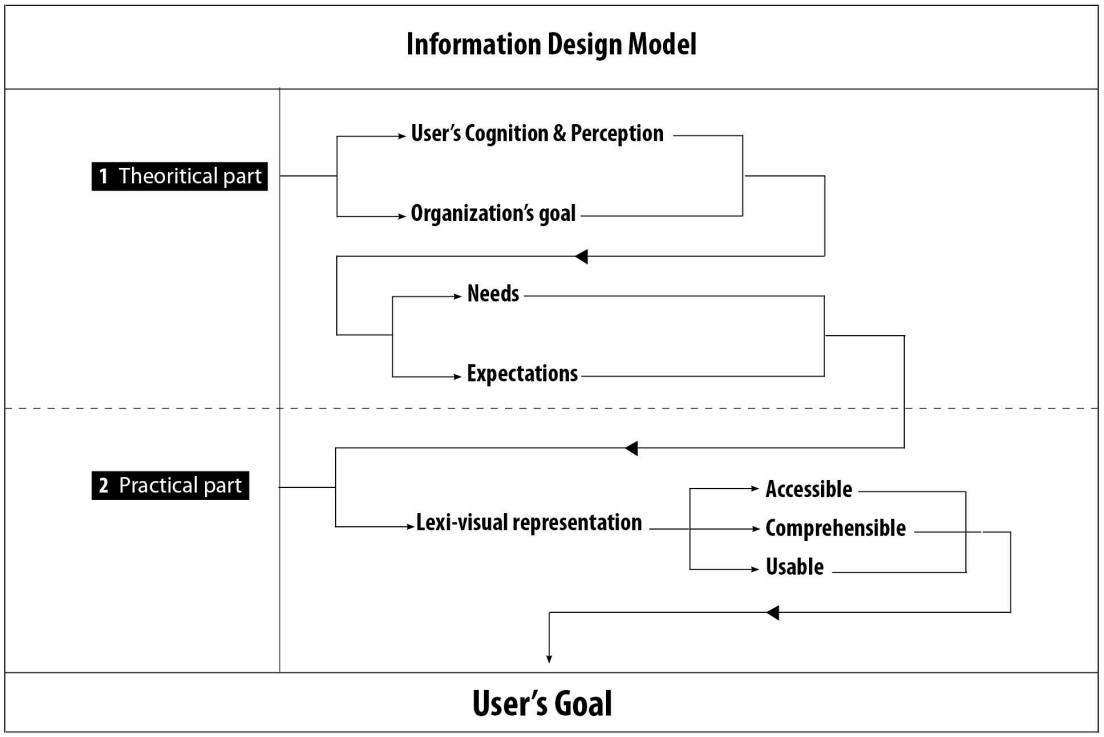


Figure 2.1: The proposed Information Design Model

The implementation of the information design theory and principles started as early as the late 1970's with the establishment of the Document Design Center in the United States and the first publication of the *Information Design Journal* in 1979 in the United Kingdom, and later the informative conference entitled" Information Design" held at Het Vennenbos in the Netherlands in 1984. At this time, a huge effort was made to improve the design of information artifacts and the system communicating with people in their everyday lives such as street signs, business forms, bank statements, route and weather maps and text books (Taylor, 2000).

Many studies have shown the impact of information design on the user's knowledge, attitude and behavior, as well as their decision making. Using the guidelines and methods of information design could provide designers and communicators in different domains with better strategies in designing their products and information. For instance, in the field of medicine, patients might find difficulties

in understanding the information in the leaflets, which might put their lives in danger. Some studies (Waarde, 2014; Lentz, Maat, & Dost, 2014) have addressed issues such as readability, legibility and text design that might improve the design of information about medicines. Results in these studies have shown that the designs that were done based on the legibility guidelines were preferred and had better scores compared to the designs that ignored the guidelines.

2.2 Information design tools

Choosing the right design tool is essential for the effective delivery of the message to the user. In the information design field two things are involved in the design process: 1) the information or the content, provided by the organization or sponsor, from which all the texts and illustrations are derived; and 2) the implementation of the visual presentation, which means building the structure of the layout (Frascara, 2015). Visual presentation can be conveyed through different tools of design. However, choosing the right design tool requires skills and understanding to the cognitive and perceptual processes to enable efficient information processing (Farkas & Raleigh, 2013).

The main communication design tools for lexi-visual representations are text, symbol, pictures, typography and layout (Pettersson, 2002). Many work areas utilize these tools in delivering information through graphs and diagrams, alphanumeric tables, teachings aids, administrative documents, instructions, control panels, wayfinding, maps and plans, catalogues and interfaces (Frascara, 2015). Integrating such design tools together could facilitate the visual processing of the information, lowers the risks of user mistakes and increases the amount of information that the user can recall. Additionally, these tools can add a level of attractiveness and interestingness to the layout, especially when the layout contains complex information. These tools could be used in both prints and in digital media production, like three-dimensional media, webpages and online forms. Additional design tools can be used in the media production such as animation, computer graphics, sound and sound effects.

Choosing an information design tool is not a random decision, it is rather a conscious decision that the designer has to take. It depends mainly on two things: 1) the purpose of the product or the organization, and 2) the designer's skills and understandings of the user's need and expectation, in order to achieve a successful communication process and positively influence people's ability to interpret the information.

2.3 Information design principles

The primary objective of an information design product is to welcome and encourage users to engage with it in a way that is clear, accessible and easy to understand. In order to achieve this

objective, it is important to be aware of the information design principles that are used to create a successful information design product. There are three main principles that are considered in information design theory, namely: cognitive principles, communication principles and æsthetic principles (O'Grady, 2008).

2.3.1 Cognitive principles

Cognitive principles mean the ability to understand human perception, thinking and learning process. Understanding how users might think, feel as they interact with the information could create effective communication (Schriver, 1997). Such understanding could provide the information designer with crucial insights to what the end-user might need and expect to see from the information design product. Being aware, even with an elementary understanding, of cognitive science and educational theory could create a major difference in the way æsthetic decisions are made (O'Grady, 2008)

2.3.2 Communication principles

Communication principles mean understanding how users transfer knowledge, share concepts, and process information through language. Communication principles involves knowing who the users are, what the purpose of the message is, and what the objective of the message is. There are a range of delivery methods to communicate with the user. Choosing the right method depends on the product itself as well as to whom this product will be presented to. There are interpersonal communication, which focus on the interaction between the individuals through one-on-one discussions, group discussions, rhetoric, advertisement, Internet, and there is mass communication which is concerned with relaying information to a broader population (O'Grady, 2008).

2.3.3 Æsthetic principles

Æsthetic principles can be found in the layout elements such as: harmony, grid system, hierarchy, colour, typography (typeface and size). As æsthetic are concerned with the final look and appearance of the information design product, applying these principles should be the result of understanding the two previous principles. For instance, choosing an unusual typeface or size could affect the information legibility. Hence, every decision taken should be based on a profound understanding of how the end-user is going to perceive it and react to it (O'Grady, 2008).

All of these principles should be tested and evaluated in terms of the successful legibility, readability and comprehensibility of the information design product. These principles are important for the user to see, understand and memorize the information presented. Moreover, considering

these principles creates a guideline for designing a successful information design product, which users can perceive positively then understand easily.

2.4 What does good information design mean?

With the increasing amounts of information becoming available daily, there is no doubt that people need to be more encouraged and engaged to read, learn, understand, and be less frustrated. Hence, good information design becomes more and more sought after. In order to explain what a good information design means, let's consider the case of a document (e.g.: a manual) that is designed perfectly, where all the graphic design principles and æsthetic considerations have been applied. However, the user is still struggling in reading or understanding this manual. From the information design point of view, this manual is not of a good design. A good information design means that the design responds to all the user needs and expectations. It answers all his/her questions, and it assists the user in accomplishing his/her task. In other words, a good information design serves its purpose, it is inviting, accessible and comprehensible. It fulfills æsthetic, economic, ergonomic, as well as the user's needs (Pettersson, 2002). Whereas, a poorly designed information design product could lead people to incorrect assumptions about how to solve a problem, and where to direct their attention. Same as what Shriver has mentioned on how a poor design could affect people's thinking and beliefs, and their ability in using texts and technology (Schriver, 1997). A good information design could have an impact on people's understandings and confidence. As such, without good information design forms would be hard to fill, instructions manuals would be hard to follow, websites would be difficult to navigate, learning materials would be overwhelming, and users will be more frustrated and discouraged.

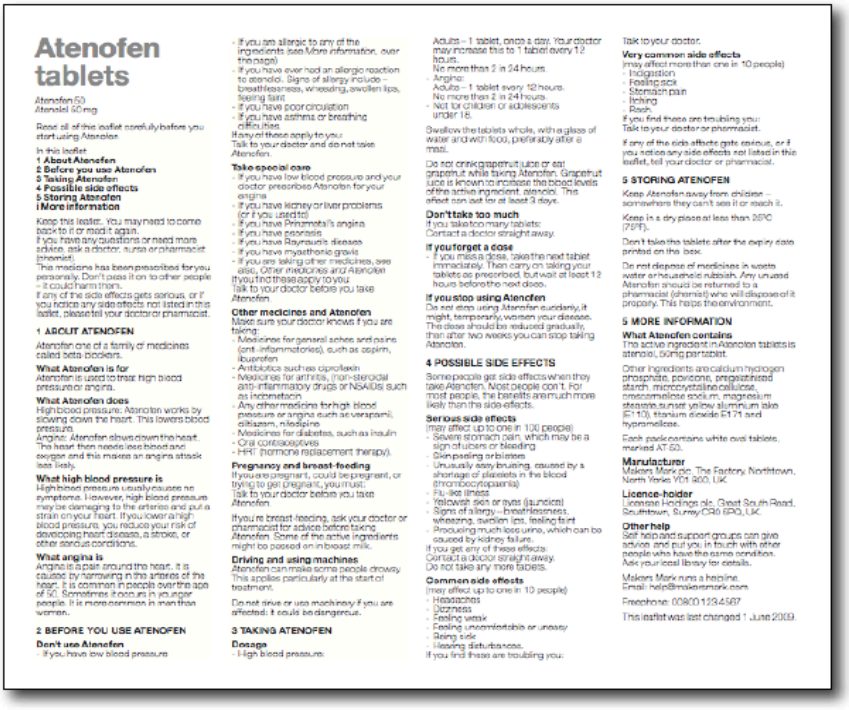
It is important for many aspects of information design that a team of people with different skills in different areas work together to make complex information easier to understand for the anticipated users (Pettersson, 2002). To this end, an interdisciplinary team may be required to achieve a good information design. For instance, when designing a manual for a product, both the product designer and the document designer ought to be integrating their knowledge and working cooperatively to create an information design product that people can utilize and benefit from. They both need to organize their instructional texts around the user and not around the features of the product (Schriver, 1997). Baer (2010) explains that information design requires an interdisciplinary team to make sure that the right decisions are being taken at each step (Baer, 2010).

A study was done by David et al. (2010) to investigate if good information design can make a difference for a specific medicine user, in terms of the performance of the package leaflets. Two designs of the package leaflets, including the same information, were used; version "A" (under-

designed) test leaflet (see figure 2.2), and version "B" (best practice) test leaflet (see figure 2.3). Version "B" of the test leaflets included specific improvements in design and layout compared to version "A". Each of the test leaflets was given to a group of the medicine users. The two groups of medicine users were then asked about their understanding of the information in the leaflets. Results of the group given version "A" (under-designed) have shown that some questions did not achieve the necessary scores, and that it generally took longer to search for the answers of most of the questions. However, the group given version "B" (best practice) have surpassed the target scores and showed generally flatter chart, with shorter and more uniform search times (David, Jane, Suzy, & Emily, 2010). Therefore, good information design infers good understandability and low cost, as well as, easy accessibility of information when it is required.

As discussed earlier in this chapter, the main focus of the information design field is the usability and effectiveness of the produced information design product. Given that the user is at the core of the information design process (as demonstrated in Figure 2.1), the way to measure how a document is performing in terms of usability and effectiveness is to determine the ability of the user to see, understand, memorize and use the information presented to him/her through this document. Given that human beings have different ways of understanding information, it is essential for the designer to utilize different methods and techniques to make the information meaningful for the different recipients. An important method in information design to achieve this is usability testing. This method is used to evaluate an information design product to determine if the product meets the desired usability criteria (Rubin & Chisnell, 2008). The usability testing is usually done by usability specialist who conducts research and studies on the user's behavior so as to inform and shape the design process in information design (Baer, 2010). This demonstrates that information design recognizes, acknowledges, and respects the differences that may exist between the designer and the user. Accordingly, in the usability testing, its first priority is to study and gather the data required on who is the information addressing? What are their goals? Values? Needs? Psychological traits? What information the they are looking for? The reason for addressing such information and through what media? (Frascara, 2015).

Furthermore, good information design does not only focus on delivering understandable information to the user, but more importantly it is invested in having the user act according to this information. Frascara (2015) stated that the application of information design must always be framed by paying due attention to who is the user, what is the message, the reason behind the message, and through what media, as people must not only understand the messages but also act according to them (Frascara, 2015).



Atenofen tablets

Atenofen 50
Atenolol 50 mg

Read all of this leaflet carefully before you start using Atenofen.

In this leaflet
1 About Atenofen
2 Before you use Atenofen
3 Taking Atenofen
4 Possible side effects
5 Storing Atenofen
i More information

Keep this leaflet. You may need to come back to it or read it again.
If you have any questions or need more advice, ask a doctor, nurse or pharmacist (chemist).
This medicine has been prescribed for you personally. Don't pass it on to other people – it could harm them.
If any of the side effects gets serious, or if you notice any side effects not listed in this leaflet, please tell your doctor or pharmacist.

1 ABOUT ATENOFEN

Atenofen one of a family of medicines called beta-blockers.

What Atenofen is for
Atenofen is used to treat high blood pressure or angina.

What Atenofen does
High blood pressure: Atenofen works by slowing down the heart. This lowers blood pressure.
Angina: Atenofen slows down the heart. The heart then needs less blood and oxygen and this makes an angina attack less likely.

What high blood pressure is
High blood pressure usually causes no symptoms. However, high blood pressure may be damaging to the arteries and put a strain on your heart. If you lower a high blood pressure, you reduce your risk of developing heart disease, a stroke, or other serious conditions.

What angina is
Angina is a pain around the heart. It is caused by narrowing in the arteries of the heart. It is common in people over the age of 50. Sometimes it occurs in younger people. It is more common in men than women.

2 BEFORE YOU USE ATENOFEN

Don't use Atenofen
- If you have low blood pressure
- If you are allergic to any of the ingredients (see More information, over the page)
- If you have ever had an allergic reaction to atenolol. Signs of allergy include – breathlessness, wheezing, swollen lips, feeling faint
- If you have poor circulation
- If you have asthma or breathing difficulties

If any of these apply to you:
Talk to your doctor and do not take Atenofen.

Take special care
- If you have low blood pressure and your doctor prescribes Atenofen for your angina
- If you have kidney or liver problems (or if you used to)
- If you have Prinzmetal's angina
- If you have psoriasis
- If you have Raynaud's disease
- If you have myasthenia gravis
- If you are taking other medicines, see also, Other medicines and Atenofen

If you find these apply to you:
Talk to your doctor before you take Atenofen.

Other medicines and Atenofen
Make sure your doctor knows if you are taking:
- Medicines for general aches and pains (anti-inflammatories), such as aspirin, ibuprofen
- Antibiotics such as ciprofloxin
- Medicines for arthritis, (non-steroidal anti-inflammatory drugs or NSAIDs) such as indometacin
- Any other medicine for high blood pressure or angina such as verapamil, diltiazem, nifedipine
- Medicines for diabetes, such as insulin
- Oral contraceptives
- HRT (hormone replacement therapy).

Pregnancy and breast-feeding
If you are pregnant, could be pregnant, or trying to get pregnant, you must:
Talk to your doctor before you take Atenofen.

If you're breast-feeding, ask your doctor or pharmacist for advice before taking Atenofen. Some of the active ingredients might be passed on in breast milk.

Driving and using machines
Atenofen can make some people drowsy. This applies particularly at the start of treatment.

Do not drive or use machinery if you are affected: it could be dangerous.

3 TAKING ATENOFEN

Dosage
- High blood pressure:
Adults – 1 tablet, once a day. Your doctor may increase this to 1 tablet every 12 hours.
No more than 2 in 24 hours.
- Angina:
Adults – 1 tablet every 12 hours.
No more than 2 in 24 hours.
- Not for children or adolescents under 18.

Swallow the tablets whole, with a glass of water and with food, preferably after a meal.

Do not drink grapefruit juice or eat grapefruit while taking Atenofen. Grapefruit juice is known to increase the blood levels of the active ingredient, atenolol. This effect can last for at least 3 days.

Don't take too much
If you take too many tablets:
Contact a doctor straight away.

If you forget a dose
- If you miss a dose, take the next tablet immediately. Then carry on taking your tablets as prescribed, but wait at least 12 hours before the next dose.

If you stop using Atenofen
Do not stop using Atenofen suddenly, it might, temporarily, worsen your disease. The dose should be reduced gradually, then after two weeks you can stop taking Atenofen.

4 POSSIBLE SIDE EFFECTS

Some people get side effects when they take Atenofen. Most people don't. For most people, the benefits are much more likely than the side-effects.

Serious side effects
(may affect up to one in 100 people)
- Severe stomach pain, which may be a sign of ulcers or bleeding
- Skin peeling or blisters
- Unusually easy bruising, caused by a shortage of platelets in the blood (thrombocytopaenia)
- Flu-like illness
- Yellowish skin or eyes (jaundice)
- Signs of allergy – breathlessness, wheezing, swollen lips, feeling faint
- Producing much less urine, which can be caused by kidney failure.

If you get any of these effects:
Contact a doctor straight away.
Do not take any more tablets.

Common side effects
(may affect up to one in 10 people)
- Headaches
- Dizziness
- Feeling weak
- Feeling uncomfortable or uneasy
- Being sick
- Upset stomach

If you find these are troubling you:
Talk to your doctor.

Very common side effects
(may affect more than one in 10 people)
- Indigestion
- Feeling sick
- Stomach pain
- Itching
- Rash

If you find these are troubling you:
Talk to your doctor or pharmacist.

If any of the side effects gets serious, or if you notice any side effects not listed in this leaflet, tell your doctor or pharmacist.

5 STORING ATENOFEN

Keep Atenofen away from children – somewhere they can't see it or reach it.

Keep in a dry place at less than 25°C (77°F).

Don't take this tablets after the expiry date printed on the box.

Do not dispose of medicines in waste water or household rubbish. Any unused Atenofen should be returned to a pharmacist (chemist) who will dispose of it properly. This helps the environment.

5 MORE INFORMATION

What Atenofen contains
The active ingredient in Atenofen tablets is atenolol, 50mg per tablet.

Other ingredients are calcium hydrogen phosphate, povidone, pregelatinised starch, microcrystalline cellulose, croscarmellose sodium, magnesium stearate, sunset yellow aluminium lake (E110), titanium dioxide E171 and hypromellose.

Each pack contains white oval tablets, marked AT 50.

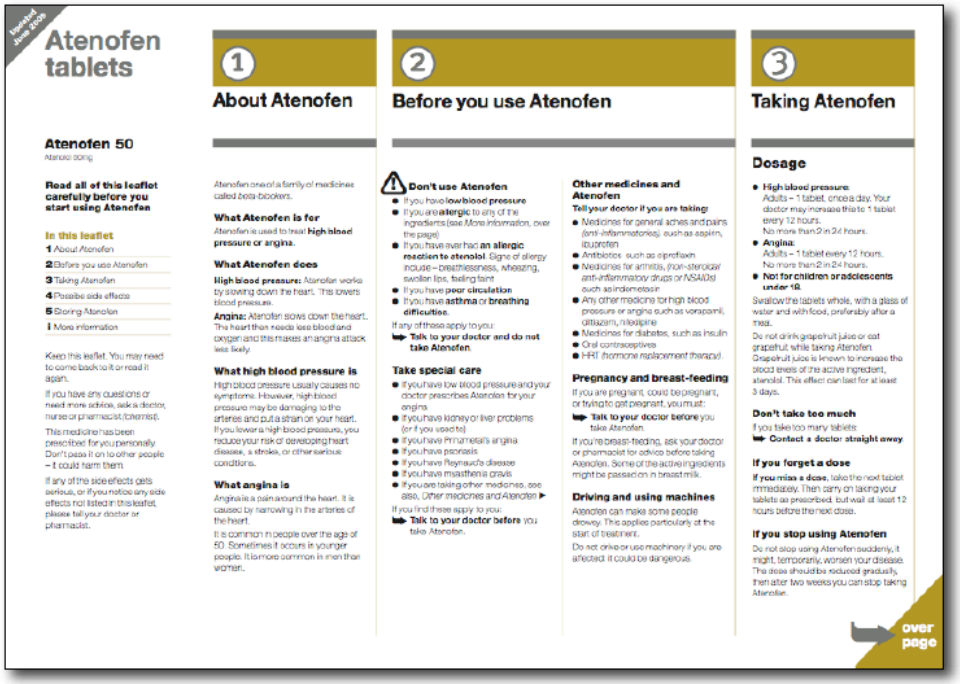
Manufacturer
Makers Mark plc, The Factory, Northtown, North Yorks YO1 9DD, UK.

Licence-holder
Licensed Holdings plc, Great South Road, Southtown, Surrey CR8 6PO, UK.

Other help
Self-help and support groups can give advice and put you in touch with other people who have the same condition. Ask your local library for details.

Makers Mark runs a helpline.
Email: help@makersmark.com
Freephone: 0080 123 4567

This leaflet was last changed 1 June 2009.



Tested June 2009

Atenofen tablets

Atenofen 50

Atenolol 50mg

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In this leaflet

Keep this leaflet. You may need to come back to it or read it again.

If you have any questions or need more advice, ask a doctor, nurse or pharmacist (chemist).

This medicine has been prescribed for you personally. Don't pass it on to other people – it could harm them.

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- If you have **low blood pressure**
- If you are **allergic** to any of the ingredients (see More information, over the page)
- If you have ever had **an allergic reaction to atenolol**. Signs of allergy include – breathlessness, wheezing, swollen lips, feeling faint
- If you have **poor circulation**
- If you have **asthma** or **breathing difficulties**.

If any of these apply to you:
➥ **Talk to your doctor and do not take Atenofen.**

Take special care
- If you have low blood pressure and your doctor prescribes Atenofen for your angina
- If you have kidney or liver problems (or if you used to)
- If you have Prinzmetal's angina
- If you have psoriasis
- If you have Raynaud's disease
- If you have myasthenia gravis
- If you are taking other medicines, see also, Other medicines and Atenofen ▶

If you find these apply to you:
➥ **Talk to your doctor before** you take Atenofen.

Other medicines and Atenofen
Tell your doctor if you are taking:
- Medicines for general aches and pains (anti-inflammatories), such as aspirin, ibuprofen
- Antibiotics such as ciprofloxin
- Medicines for arthritis, (non-steroidal anti-inflammatory drugs or NSAIDs) such as indometacin
- Any other medicine for high blood pressure or angina such as verapamil, diltiazem, nifedipine
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Do not drink grapefruit juice or eat grapefruit while taking Atenofen. Grapefruit juice is known to increase the blood levels of the active ingredient, atenolol. This effect can last for at least 3 days.

Don't take too much
If you take too many tablets
➥ **Contact a doctor straight away**

If you forget a dose
If you miss a dose, take the next tablet immediately. Then carry on taking your tablets as prescribed, but wait at least 12 hours before the next dose.

If you stop using Atenofen
Do not stop using Atenofen suddenly, it might, temporarily, worsen your disease. The dose should be reduced gradually, then after two weeks you can stop taking Atenofen.

over page

Figure 2.3: version "B" (best practice) test leaflet (David et al., 2010)

2.5 Information design and user's cognition and perception

Information design is mainly concerned with presenting information to the user in a way that the user would perceive effectively, so that he/she could act accordingly. As such, studying how the user sees, perceives and understands is essential to designing effective information design products. This in turn makes cognition science and studies crucial to information design. In fact, all design disciplines that require user's action or attention demand a good understanding of how user perceive, store, understand and remember information.

Cognition can be defined as the process of acquiring and understanding knowledge. Perception can be defined as the ability to become aware of something. Accordingly, cognition and perception are related to what goes inside the user's mind, from thinking, learning, planning, decision making, problem solving, etc. Studying what is inside the user's mind is essential for designers, in order to create what the user needs and expects to see, learn and understand. Moreover, incorporating prior experience, knowledge, and anticipations could be helpful when designing an information design product (Mandel, 1997).

The importance of cognition and perception to information design has been realized in the work of Carliner (2000). In this work, he proposed a model of information design that is based on three levels. The first of these levels is the physical level which is mainly concerned with the ability of the user to physically find the information. The second level is the cognitive level which deals with the ability of the user to understand the information. Finally, the third level is the affective level which is concerned with answering the question: will the user want to use the information after finding and understanding it? (Carliner, 2000). Based on Carliner's framework of information design, the cognitive design comprises the following activities:

1- Analyzing the user needs and creating scenarios for the information that the user might need.

2- Setting goals for the design project.

3- Choosing the form of the communication product.

4- Preparing the design of the communication product, which is developing an information map that shows the structure of information in the communication product.

5- Setting the guidelines which includes the style guide, dictionary and communication product specifications.

Considering these activities in the design process is important for creating effective information design products. A design that is based on principles of cognition and perception is more likely to be well-presented and conveyed to the user. Many studies have shown the effect of cognitive design principles on user's performance and preference. For example, grouping as a principle of perception was shown to have cognitive benefits for the reader, and to decrease the complexity of a content (Schriver, 2013). Another study by Frascara (2015) has shown that to provide insights on the reason why users might find documents, forms, instructions to be more difficult and confusing, an understanding user's cognitive responses is needed (Frascara, 2015).

2.6 Importance of visual rhetoric in information design

Information design products usually enclose both visual and verbal content. Utilizing both contents in a suitable way assists in conveying the product's message to the user successfully (Schriver, 2013). Using visual rhetoric as a persuading tool in information design could contribute in influencing people to change their beliefs or attitudes (Hill & Helmers, 2012). Furthermore, studies have shown that people are more likely to easily recall a content that is visually presented, compared to a content that was verbally presented to them (Paivio, 1969). Thus, visual rhetoric is an important consideration in information design and it enables using visual design features to convey meaning. However, the use of visual rhetoric should be to a certain limit, otherwise it can overload the design and add complexity. For instance, when the visual information design tools are poorly chosen, they could increase the complexity of a document. For example, a certain type of typography that works very fine in one document can increase the complexity of another document. Black et al. (2017) explain that different design fundamentals contribute in the rhetoric of a good design (Black et al., 2017). These design fundamentals include:

1. The use of graphic elements (bulleted- charts-diagrams-graphs and tables),
2. The appearance and the attractiveness of the document,
3. Designing the structure of the document and how it supports its purpose ,
4. Introducing emphasis using different type weights and sizes.

Rhetorical tradition was the art of persuasion, by finding communication strategies to use through public speaking (Hill & Helmers, 2012). Nonetheless, a rhetoric approach nowadays is used to provide document design with a rich theoretical framework for thinking about complex relationship between the communicator, the audience, the words, and the pictures and the content. Using visual rhetoric in presentations and organizations creates meaning that the audience could relate to, as well as, it helps to achieve a coherent relationship between information. Moreover, it could make the

information more accessible in decent amount of time (Black et al., 2017). Visual rhetoric is considered to be an important element in increasing the effectiveness of the process of information exchange. It facilitates the communication process with the audience. In fact, visual rhetoric helps the audiences in assigning meaning to what they feel and believe (Albakry & Daimin, 2015).

2.7 Information design and public documents

Unlike art, which can thrive in poor economies, public information availability, design and provisions are highly associated with rich economies (Black et al., 2017). Public documents provide people with a wide range of information that require their attention, understanding, and action. Based on the principles of good governance, the regulatory and public information included in the public documents should always be written and presented in the clearest possible way for the public to understand (Kimble, 1996). However, public documents are still rarely designed to a high standard, despite many well-meaning attempts to achieve that (Sless, 2004).

As mentioned earlier, public documents design demands a combination of content structure, appropriate wording and visual formatting for the public to comprehend (Black et al., 2017). Two things should be done by the public document designers to help readers understand their documents: 1) visibly structure the document to catch the main idea, and 2) both visual and verbal languages should be used to connect the reader to the document, as a good writing and visual design have the potential to make a difference (Schriver, 1997). The lack of formal training in writing or design might lead to ineffective design decisions that could have an impact on the public document success. Another issue is that for document designers to do a valuable and effective job, they need better knowledge about their readers, less limitations and more control over the text. Finally, to help them be more creative in their process they need to have a decent compensation for their work and time (Schriver, 1997). Furthermore, to ensure that the public information included in the public documents can achieve its purpose of informing the public, public documents needs to be designed and studied with a consideration of the different aspect of information design (Black et al., 2017).

Chapter 3

Gestalt principles of perception

3.1 Introduction to Gestalt theory

Gestalt is a German word which can roughly be translated into English as "form", "shape" or "pattern". Gestalt psychology was developed in the early twentieth century by the German researchers Max Wertheimer, Wolfgang Köhler, and Kurt Koffka. At its core, Gestalt psychology attempts to explain how humans organize individual elements into groups to acquire and maintain meaningful perceptions (Nesbitt & Friedrich, 2002). Gestalt psychology grew in Germany at the same time when Behaviorism grew in the United States. Both branches of psychology attempted to explain human behavior. In contrast to Behaviorism which was only concerned with observable behavior, assumed that all human behavior is learnt and as such was focused on learning, the Gestalt psychology was less focused on the observable behavior and was more focused on the visual perception. The main purpose of the Gestalt psychology was to explain why, in natural settings, the world looks the way it does to the ordinary people (Schriver, 1997).

Since then, the Gestalt theory has grew out of the field of psychology and has influenced researchers from a variety of disciplines, including but not limited to, linguistics, industrial design, human computer interaction, art and visual communication (Graham, 2008). Gestalt theory focuses on the human mind and perception as a whole. It addresses how our minds tend to perceive and observe elements around us. Gestalt theory argues that while each individual element has its own characteristics, the nature of an element cannot justify how this element is perceived. Hence, the main notion of the Gestalt theory is that the perception of the whole pattern cannot be explained from the sum of their part (Rock & Palmer, 1990). Gestalt theory is currently considered to be one of the most important perceptual theories for perceptual organization (Chang & Nesbitt, 2006). The founders of the Gestalt school of organization desired to generate principles that would help them address the questions and complex phenomena with which the Gestalt psychologists were concerned; namely "How do people perceive scenes and spaces; how do they solve complex problems; how to they relate different components of their experience to each other, regardless of the domain of their experience" (Flieder & Mödritscher, 2006). The Gestalt school of organization offered validated scientific structures and principles that were used to explain and enhance the visual work of design educators in the mid-twentieth century (Graham, 2008).

Several experimental psychologists have been key in the foundation of the Gestalt school of organization. However, many of these psychologists are rarely mentioned in the literature because

their work was never translated into English (Vezzani, Marino, & Giora, 2012). Important among these psychologists is Georg Elias Müller (1850-1934). Müller is considered to be one of the most influential figures in early experimental psychology. He founded an important laboratory for psychological research at the University of Göttingen, where he worked on memory, thinking, and color perception in the period from 1881 to 1921. Another important experimental psychologist is Friedrich Schumann (1863-1940). Schumann was Müller's assistant in the period from 1881-1894. He became famous in Frankfurt in 1910s, when he was assigned the directorship of the Institute of Psychology. Soon after, Wolfgang Köhler and Kurt Koffka became his assistants and came across with Wertheimer. A while later, Wertheimer, Köhler and Koffka started working together founding the Gestalt school of organization (Vezzani et al., 2012).

The Gestalt school of organization was the first to identify the organization as a theoretical issue. The Gestalt principles of organization (also known as *Gestalt Laws* or *Factors of Grouping*) were mainly recognized by Max Wertheimer. Although, not all of the factors were founded by Wertheimer, he was the first to articulate them with a full realization of their fundamental importance. Wertheimer presented a theoretical framework that considers and accounts for the perceptual organization facts (Vezzani et al., 2012). A number of the foundational Gestalt principles introduced by Max Wertheimer where later expanded on by Kurt Koffka (such as closure, common fate, good continuation, proximity, similarity, figure-ground relationship and prägnanz). Two principles were introduced at a later stage by Stephen Palmer after he studied the principles that were identified by Wertheimer. The first of these principles is "Common Region" which is used to understand complex relations after some depth perceptual processes has been achieved. The second principles is proposed by Palmer and Irvin Rock named "Uniform Connectedness" which is used as a grouping factor (Kimchi, 1998).

It is important here to highlight that the Gestalt theory borrowed and employed ideas from preceding scholars and theories. However, the founders of the Gestalt theory have reworked these ideas in an original and effective way that at the beginning of the 20th century the newly developed Gestalt theory became more promising and convincing than its preceding literature (Vezzani et al., 2012). Accordingly, while the Gestalt theory may have used ideas and factors of organizations from previous work, the innovation in their modification and employment made them associated with the new theory (Helson, 1969).

3.2 Gestalt principles of perception

This section will present the most pertinent Gestalt principles. The following principles will be introduced: law of prägnanz, similarity, proximity, figure-ground relationship, uniform

connectedness, good continuation and closure. For each of these principles, a brief history of how this principle was developed along with a description and an example of the principle in practice will be provided in the following subsections.

3.2.1 Law of Prägnanz

Prägnanz is a German word meaning pregnant in English, but in the sense of pregnant with meaning and not with a child (Boeree, 2000). The law of Prägnanz is described as "the tendency to interpret ambiguous images as simple and complete, versus complex and incomplete" (Lidwell, Holden, & Butler, 2010: 144). The outcome of this effect is what the Gestalt psychologists designate as the human inclination toward sense making. Besides improving the sense of an engagement for the recipient, this principle results in demanding less cognitive resources to transform or encode images by interpreting them in the simplest possible form (Lidwell et al., 2010). Hence, the law of Prägnanz could facilitate the communication of information or the bolstering of an emotional response from a recipient. This law was identified as a tool for attaining an interesting combination and was as such used as a tool to engage the users in graphical user interfaces (GUI) (Fraher & Boyd-Brent, 2010). The law of Prägnanz was one of the principles recognized by the scientific community prior to Wertheimer's publication. As a matter of fact, this law was cited by earlier works published between 1914 and 1923 (Vezzani et al., 2012). Figure 3.1 demonstrate an interesting example of the law of Prägnanz. While the figure shows a layout of a four-part image collage, at the first instant most recipients would interpret the image as a single face, as this is the simplest explanation requiring the least cognitive effort (Fraher & Boyd-Brent, 2010).

Figure 3.1: Four-part image collage (Fraher & Boyd-Brent, 2010)

3.2.2 Similarity

The principle of similarity states that people tend to group similar elements together based on attributes such as color or shape, even if the elements are spatially separated (Wertheimer, 2012). The grouping that result from this principle reduces complexity and emphasizes the relatedness of the design elements. Moreover, changes in the shape and/or color of the design elements could help in the perception of multiple separate chunks and reinforce differences among the elements. This principle is applicable to the design of information. By keeping texts, links and/or animated elements similar, the designer can induce the recipient to perceive that the similar elements fit together (Graham, 2008). For design purposes, the strongest grouping effect can be achieved through the use of color. Second to colour comes the use of the element's size, especially when the sizes of the elements are of noticeable differences from one another. Finally, is the shape which is considered to be the weakest grouping strategy of all and is best used when both the color and the size of the elements are similar (Lidwell et al., 2010). Furthermore, similarity could be applied in haptic elements as in visual element. Figure 3.2 shows an example of how the principle of similarity is applied in the same way for both visual and haptic grouping of elements. In visual grouping elements are grouped by color, while for haptic grouping the surface texture is used to identify the grouping of the elements. Applying the principle of similarity can reduce complexity and increase recipient's recognition of the design elements that are related to (or differentiated from) one another. Moreover, this principle helps maintain the recipient's attention while reading and eludes any visual distractions that could otherwise occur.

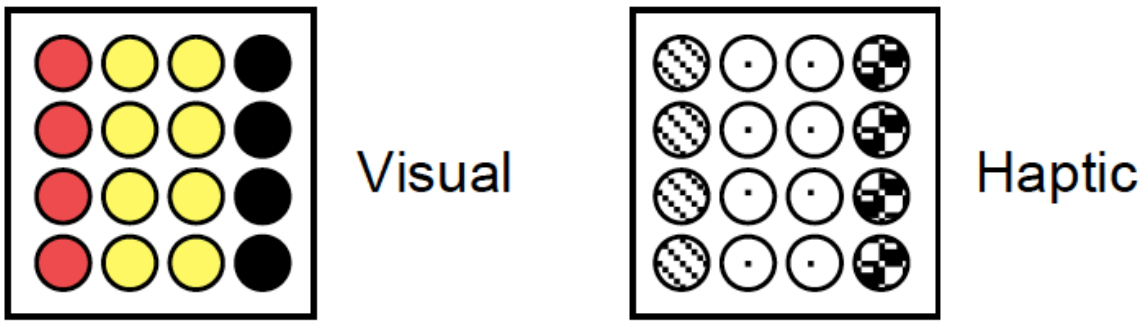


Figure 3.2: An example of how the principle of similarity is applied in the same way for both visual and haptic grouping of elements. (Chang, Nesbitt, & Wilkins, 2007)

3.2.3 Proximity

The principle of proximity was first introduced by Müller as the "coherence factor". Müller explained that objects that appear to be close to each other are perceived by recipients as a group, or a chunk, whose components are more likely to be related to one another compared to those who are

farther apart (Chang et al., 2007). In this regard, Müller acknowledged Schumann's role in the introduction of this principle. Schumann later described the grouping of the parts in a whole by both proximity and symmetry. Schumann was the first to make an attempt to specify the objective factors that determine the relation between the whole and its part (Vezzani et al., 2012). Schumann explained that for elements arranged equidistantly, the grouping is arbitrary and depends totally on choice and can be changed extraordinary easily, as shown in figure 3.3. He also added that by grading the size of the space, a specific grouping always appear involuntarily and can only be changed afterwards at a great deal of effort. In figure 3.3, we can see that at the first level four small areas from a group, and then at the next level four of such groups from one unit (Vezzani et al., 2012).

Proximity is also recognized as the principle of "nearness", and the "law of proximity" (Black et al., 2017). From a design perspective, the grouping resulting from proximity decreases complexity in the design and strengthens the connection between the elements. Furthermore, spatial proximity is known as one of the important organizing principles in information design for enhancing the perceptual organization of data (Black et al., 2017). Hence, this principle is considered one of the powerful tools in design concerning the relatedness. Moreover, it supersedes similarity of color and shape, as well as, other factors that might differentiate a group of objects, as shown in figure 3.4. On the other hand, the inadequate proximity gives the wrong visual impression to the recipient regarding how the information is to be grouped and utilized (Moore & Fitz, 1993).

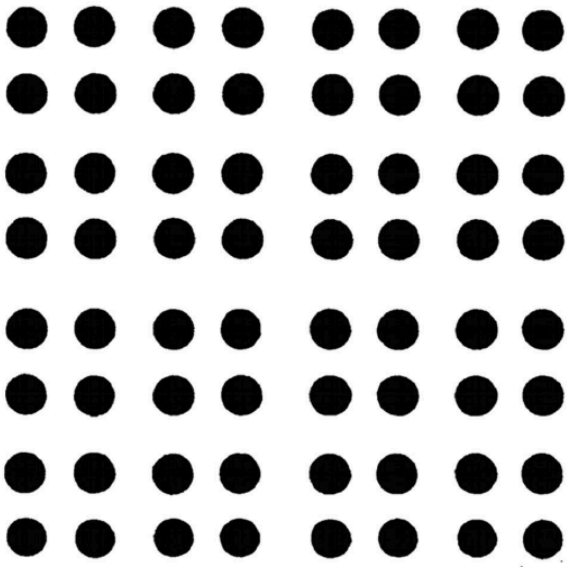


Figure 3.3: Grouping by proximity (Vezzani et al., 2012)

Figure 3.4: Grouping by proximity that overrides similarity (Lanoue, 2016)

3.2.4 Figure-ground relationship

Figure-ground relationship is considered an essential aspect of field organization. The figure-ground was first attributed by Edgar Rubin (1886-1951), who worked under Müller's supervision in Göttingen, in 1915. Rubin published his famous work on figure-ground organization, which was then incorporated into Gestalt theory in 1921 (Palmer & Rock, 1994). However, Robin never identified himself as a Gestaltist (Vezzani et al., 2012).

A "figure" is a shape that is recognized in front of or enclosed by a homogenous background. Figures cannot be perceived unless they are separated from their backgrounds (Moore & Fitz, 1993). The higher the contrast the better figures will be recognized and vice versa. As shown in figure 3.5, it is obvious that it could be seen from two perspectives by changing nothing but our attitude. There is no right or wrong way to see it, but it all depends on our own perception in seeing it. Hence, this principle emphasizes that the human perceptual system separates stimuli into either a figure elements or ground elements (Lidwell et al., 2010). Schriver (1997) mentioned that we perceive the color, shape and size of the object depending on its background. Meaning that an object could be the same size, however it can be perceived differently if it is presented in different background as shown in figure 3.6.

In the design practice, when both the figure and the ground elements are well-defined, it means that the relationship is stable, the figure receives more attention and is better remembered. Moreover, the reader will be able to easily identify the figure without any confusion. However, when the figure and the ground are not clear, the relationship is unstable and more likely to increase the perceptual confusion. Here are some visual keys presented by Lidwell et al. (2010) to avoid any confusion between the figure and the ground:

- The figure's shape is more defined that the ground
- The ground surrounds the figure

- The figure is closer and in the foreground, while the ground is further away and it doesn't have a clear location.
- The elements located below the horizon are perceived as figures, while elements located above the horizon perceived like ground.

Figure 3.5: Face illusion "George C Boeree, 'Gestalt Psychology,' 2000," n.d.)

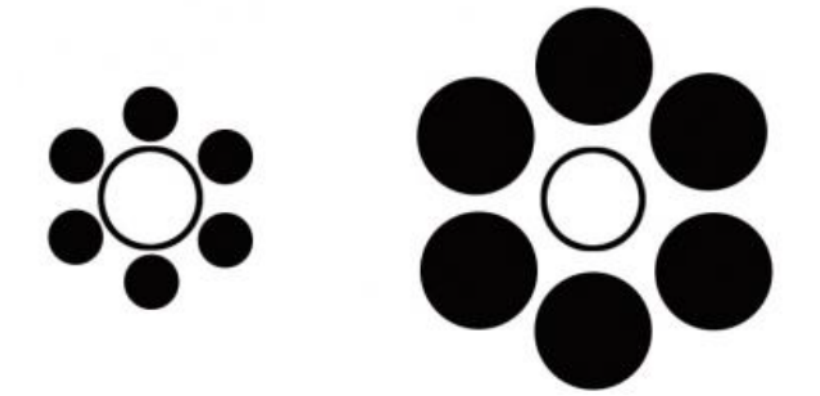


Figure 3.6: A size illusion (Schriver, 1997)

3.2.5 Uniform connectedness

The principle of uniform connectedness is a recently introduced principle to the Gestalt principles of perception. This principle states that elements that share same visual properties (such as color) are perceived to be more related than elements that do not share same visual properties (Lidwell et al., 2010). Another definition given to this principle is "t*hings that are physically connected are*

perceived as a unit" (Nesbitt & Friedrich, 2002). Lidwell et al. (2010) stated that there are two ways in applying uniform connectedness in a design: the first is common regions, which are designed when edges come together and bound in a visual area. This technique is widely used to group software buttons and buttons on remote controls. The second is connecting lines, this method is designed when elements are joined together using a specific line. This technique is used in joining elements that are not grouped together or located far from each other. Figure 3.7 shows different examples of the principle of uniform connectedness application.

Uniform connectedness is a powerful tool in the design of information. In fact, it overpowers both principles proximity and similarity. From its definition, the physical aspect that is added to the elements augments the perceptual cognition and allows this principle to conquer the other Gestalt principles of perception. As can be seen in figure 3.7, even though the similarity and proximity are consistent, elements that are connected (by either common regions or lines) are perceived to be more related.

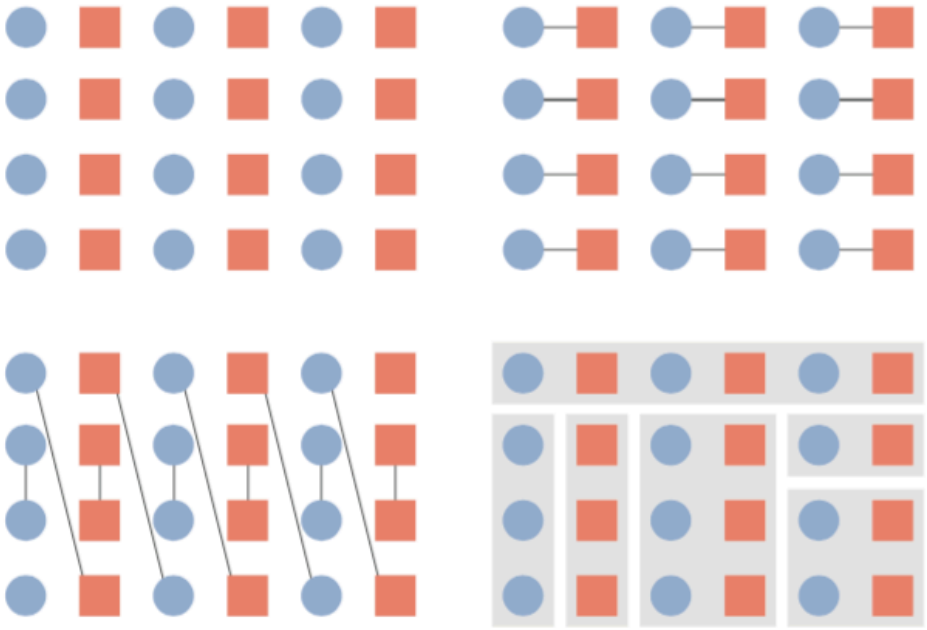


Figure 3.7: Uniform connectedness (Lidwell et al., 2010)

3.2.6 Good continuation

The good continuation principle is described as "elements arranged in a straight line or a smooth curve are perceived as a group, and are interpreted as being more related than elements not on the line or curve" (Lidwell et al., 2010 p.116). This principle also indicates that a pattern with a good continuation may suggest to the viewer that the patterns continue beyond the end of the pattern. Meaning that the viewer naturally fills in the rest of the pattern. An example of good continuation

principle is shown in figure 3.8. Viewers tend to see the coyote's footprints labeled (d) as a continuation of the footprints labeled (a), and those of labeled (c) as a continuation of those labelled (b) (Schriver, 1997). A good continuation allows us to mentally trace the path between two elements even if the pattern is intersected with minimal disruption, the elements by the line will be perceived as related (Schriver, 1997). The larger the angle of the disruption becomes the less the elements will be perceived as related (Lidwell et al., 2010)

Good continuation is used in the design when elements need to be connected. For example, having related elements with the same alignment paths and unrelated elements with different alignment path. The more you break the alignment the further the relation will be between the elements.

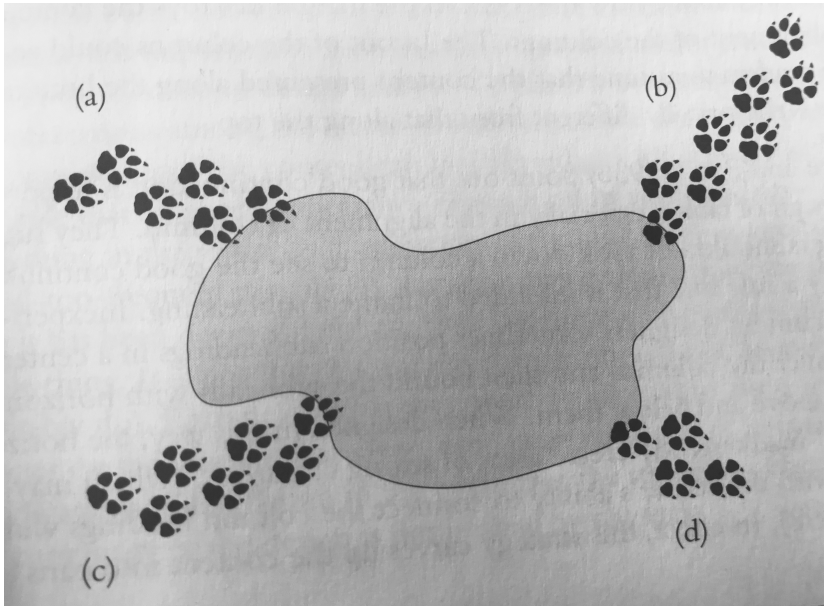


Figure 3.8: An example illustrating "good continuation is working (Schriver, 1997)

3.2.7 Closure

The principle of closure states that a viewer tends to perceive a set of separate elements as a single, identifiable pattern, rather than individual elements (Lidwell et al., 2010). In fact, when there is a visual presentation that has missing parts or gaps, whether it is a line, shape, pattern or text, people tend to pay attention only to what is present in front of them and complete or fill the gaps (Graham, 2008). Figure 3.9 shows an example of the principle of closure. As shown in this figure, even though the shape is not a complete circle, it is still perceived as a circle. As mentioned in Lidwell et al., 2010, the energy needed to recognize a form or a pattern is less than that needed to perceive the elements individually. Hence, it demands less perceptual cognition from the viewer.

Besides, this principle adds simplicity, yet interestingness to the design. Using the recognizable patterns and removing the unnecessary elements could reduce complexity in the design, moreover it leaves more room to the viewer to participate into the design. Closure principle is used in logo design as it demands simplicity and minimalism in the design.

Figure 3.9: The elements are perceived holistically as a single pattern first circle, and then as an individual elements (Lidwell et al., 2010)

3.3 Applications of Gestalt principles in reducing complexity and improving user perception

Gestalt principles have been implemented as a fundamental theory in a number of research areas such as: painting, sculpture, graphic design and information design. Moreover, since their introduction in the early twentieth century, the Gestalt principles were examined and studied various times to improve the visual perceptual process. As a result of this work, stronger theoretical and experimental frameworks (such as cognitive science) have been developed since the 1960s and 1970s and have dominated this field of study ever since (Wagemans et al., 2012). The reason why the Gestalt principles were applied by visual artists, communicators and designers is that these principles provide a scientific approach and a logical explanation of human perception and human intentions, and inclinations, in grouping things (Graham, 2008). In addition, these principles were able to provide a rational explanations of why shifts in space, time and configuration could have a big impact on the meaning of the presented information (Graham, 2008).

The application of the Gestalt principles in enhancing user's perception of relational changes in a graph was examined in a study conducted in Australia (Nesbitt & Friedrich, 2002). The authors of this study focused on graphs formed of nodes and links and used to represent and visualize abstract data in a spatial layout so as to help users build a cognitive model (i.e., a mental map) of what would otherwise be abstract data. The authors argued that the slightest changes in the data represented by such a graph can lead to dramatic changes in the graph representing it, leading to the confusion of the users as they completely lose the mental map they previously had of the graph and

the data it represented. Using animation between the two versions of a graph was adopted to help the users maintain their cognitive model of the data. Recognizing that the Gestalt principles can define how elements presented together tend to be grouped by a recipient into separate patterns, the authors applied the Gestalt principals to the animation between the two versions of the graph in order to assist the users in comprehending the structural and visual changes in the layout of a graph through visual perceptual grouping.

The application of Gestalt principles in the field of genetics was examined in another study (Yu, 2014). This work focused on the important role that visuals can play in the public communication of science, as a promising vehicle to demonstrate theoretical and invisible information. In this study, the Gestalt principles were applied to reduce the complexity of genetics illustrations used to raise the public understanding towards genetics concepts. First, to examine the visual communication of genetics in popular science education sources, 370 genetics articles from the past 20 years (comprising over 530 genetics illustrations) were examined using cognitive load theory and Gestalt theory. Second, this study proposed several heuristics for coding information in genetic illustrations so as to assist designers and science communicators in creating well-defined, accessible and viewer friendly genetic illustrations aimed for public readers. Lastly, an integration was done of verbal labels into the illustrations to explain visual codes. In this step, the Gestalt principles of perception were applied in presenting the genetics illustrations. The results of this study showed that the integration of the verbal labels observing and considering the proximity, continuity and enclosure had a big impact on the visual appearance of the illustrations. They assisted readers in better understating the illustrations. Moreover, they reduced the illustrations complexity and enhanced the accessibility of information.

The application of the Gestalt principles for enhancing visual communication in the field of interactive media design was considered in a study done by Graham, 2008. In this work, the author examined how the main Gestalt principles were applied in the field of two-dimensional design (such as logos, posters, etc.) and hence attempted to apply them within the context of interactive media design that include motion and interaction (such as websites, multimedia documents, etc.). The work in this study revealed several important results. First, the principle of figure-ground relationship was shown to be an important tool to apply in interactive media design. It was shown that figure-ground relationship can assist the user in recognizing any visual changes if an action has to (or will) be taken. For example, when the user rolls over a link with the cursor, the link typically changes color (or is changed in some other way) to provide the user with feedback that an action will happen should the link be clicked. Second, the principle of proximity was shown to be

important in creating a visually organized design for the user to understand the related information. To demonstrate this, the author used an intuitive example from Web pages design. In a Web page, when the text and links are placed far from each other, it is harder for the user to decide which information are related to each other. Third, the principle of closure was shown to be particular importance when dealing with an object that has a predictable pattern, this principle could help the reader to easily remember the pattern and fill in the missing parts. Forth, it was demonstrated that the principle of similarity, in interactive design, helps the reader perceive that the elements goes together either physically or conceptually. Besides, it reduces the complexity of the presented information. Lastly, the principle of good continuation was shown to have an essential role in interactive design, as it can be used to attract the reader's eye to a specific content by using moving lines for instance. In summary, this study has demonstrated that understanding the Gestalt principles and using them in the framework of interactive media design and provide a scientific structure that can help designer analyze and visually improve their interactive design.

The work by Chang et al. (2007) demonstrated that while different studies have investigated how the Gestalt principles were applied to understand the visual perception, there is a lack of work investigating the application of the Gestalt principles to understand haptic (tactile) perception and perception arising from multiple senses. Focusing on multi-sensory displays, this study used the Gestalt principles framework to investigate how individuals perceive the sense of touch in grouping display elements. The results of the study showed that when there is an equal spacing between elements, texture and color can be used in grouping elements. Hence, the principles of similarity and proximity can be both applied in visual and haptic grouping.

Gestalt principles were employed in another study as a framework for guiding human-computer interaction (HCI) (Fraher & Boyd-Brent, 2010). In this study they examined the Gestalt principles as an approach in improving the engagement of user interaction and how they can be used as a guide for human perceptual and cognitive methods in HCI. The results of this study indicates that a Gestalt approach provides a substantial assistance in creating an interface that promotes user interaction, as well as, in improving the user's engagement.

3.4 Gestalt principles and public documents

As discussed in the previous sections, the Gestalt principles of perception has been proven to be effective in many fields of study, such as visual communication, information design, science and data visualization. The Gestalt principles can be employed deliberately to enhance meaning and improve the understanding of information through the use of effective designs of texts and graphics (Moore & Fitz, 1993). Moreover, the Gestalt principles have been proven as a framework for

targeting human perceptual and cognitive processes. As mentioned by Nesbitt & Friedrich (2002) Gestalt principles are simple to state, apply and understand. They are considered more of a tool than laws. Accordingly, applying the right principles will create a possibility for improving the visual design, and will accordingly have a positive impact for both designers as well as the users.

There is no doubt that information and public documents designers seek a reliable method to ensure not only the quality of their information product, but also the usability of such a product. For this, it is important for the designers to understand human perception and cognition in order to have strong insights on how the viewer will perceive their product. Following that designers could use these insights for guidance in creating a successful design product. Gestalt principles enable the designers to understand visual perception, which makes these principles an essential tool to employ on the design of public documents. Gestalt visual principles are influential and therefore can enable clearer public communication and ensure public consideration of the design products.

A very important aspect of document design is æsthetic evaluation of the information presented in the document. Readers intend to evaluate the documents from the first sight and before they start reading them, how do they look? and how the visual elements are being structured? Therefore, using beneficial guidance provided by psychologists who studied how people group and organize what they see is essential in the design process of documents (Schriver, 1997). The application of Gestalt principles could enhance the usability of public documents in terms of attractiveness, readability, and usability. Moreover, it can help designers achieve their rhetorical goals. Yet, Gestalt principles are not basically rhetorical, but they can be used as tools to provide the designers with more insights concerning how the readers would like to perceive from the document.

In conclusion, the implementation of the Gestalt theory has been proven to be successful in many fields. In this regards, the implementation of Gestalt principles of organization will be studied and examined for the public document. Moreover, studying the Gestalt principles application could help the public documents designers in designing documents that are well-structured, less confusing and more meaningful for the readers. Given that, public documents could sometimes be difficult and complex for users to grasp. Such implementation could help readers utilize all the clues in their visual field to construct meaning from the displayed content. Additionally, Gestalt theory has provided a number of intuitive guidelines and standards, that explains how users perceive visual organization (Flieder & Mödritscher, 2006). Hence, by applying those principles on any subject or document, it could transform these documents to more comprehensible documents, that can be easily perceived and comprehend by the users.

Chapter 4
Methodology

In chapter two, the role of information design in designing public documents was presented. In chapter three, it was shown that the Gestalt principles have a positive impact in improving user's perception and cognition of visual communications in various fields. In this chapter, first we will study the presence of the Gestalt principles in public documents, as well as, their impact on the usability of these documents. Second, we will identify which of those principles could be better integrated in the design of public documents so as to improve the document quality and usability.

Thus, to achieve the research objectives, this methodology comprises two main phases.

- **Phase one** is an analysis phase, utilizing two method: A) Heuristic evaluation method, a method to evaluate the usability of the documents (Nielsen, 1994). B) Document analytics, a detailed analysis of the documents design features.
- **Phase two** is the redesign phase, with the application of the Gestalt principles.

4.1 Selection of documents

There is no doubt that public documents need to be well-understood, as usually a decision has to be taken based on the user's perception and understanding of the information presented in such documents. Moreover, if they are poorly designed, public documents can affect their users self-confidence, as people tend to blame themselves if they cannot understand public documents (Schriver, 1997). However, public documents are often known by their complexity and that they are not designed to be viewer friendly (Sless, 2004). For these reasons, the researcher was motivated to examine public documents, in terms of their usability and effectiveness in delivering information.

After reviewing over 440 public documents issued since the year 2000, we selected two public documents as the focus of this study. These two public documents were selected as they were found to be the most dispensed in Québec City among those examined. The first document is an election card for Québec City 2005 municipal election, which was distributed to over (two hundred thousand voters), shown in figure 4.2. The second document is an electric bill issued by Hydro-Québec. Hydro-Québec is the main supplier of electricity to the residents of Québec city, shown in figure 4.3. The bill of Hydro-Québec is distributed every month to over 3 million customers. Consequently, this study will examine the usability of information, as well as the presence of the Gestalt principles, in these two documents.

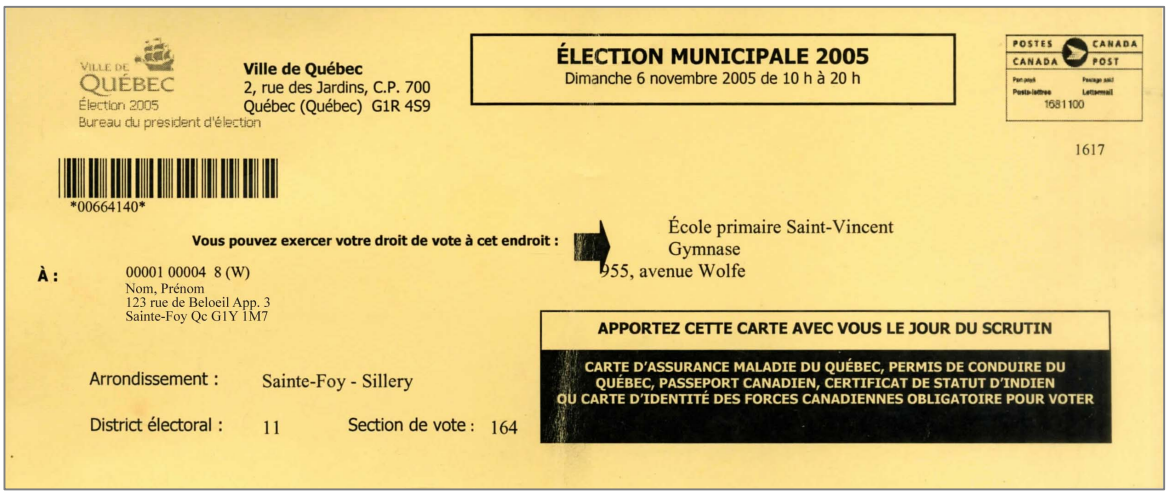


Figure 4.1: An election card for Quebec City in the year 2005

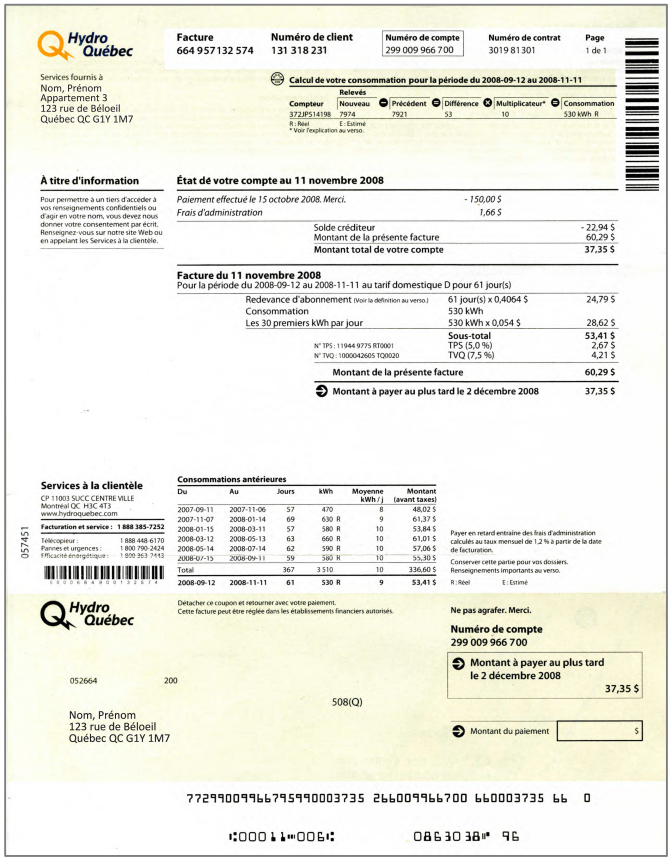


Figure 4.2: The electric bill of Hydro-Quebec

4.2 Phase 1-A: Heuristic evaluation as a measuring tool

In order to study the role of the Gestalt principles in the selected documents and to be able to identify which of the Gestalt principles could be applied and utilized to improve their design, we have to first identify the existing usability problems in these documents. Accordingly, a usability method named heuristic evaluation method will be used in this study to assess the usability of the selected documents and assist in finding their usability problems.

The heuristic evaluation method was originally developed as a usability engineering method. This method is considered to be one of the inspection methods, along with other methods including usability walkthroughs, cognitive walkthroughs and application of guidelines in walkthroughs (Nielsen, 1992). Indeed, usability methods are mostly used on a wide variety of both software and hardware interfaces (human-computer interactions). Furthermore, these methods have been increasingly developed, refined and used in different ways (Nielsen, 1994). The heuristic evaluation method is utilized in user interface design, and is defined as "an informal method of usability analysis where a number of evaluators gather with an interface design and are requested to evaluate it and judge its usability" (Nielsen & Molich, 1990). Particularly, this method provides a way for assessing the usability of the software design with respect to specific criteria that are pre-determined for guiding the evaluation process. The heuristic evaluation method requires professionals in the field to participate in its application. Having expert evaluators is needed for the application of this method in order to minimize the time and effort required for understanding the basic inspection (the heuristics and the guidelines) and to ensure that the evaluators have a solid understanding and proficiency of the criteria they are evaluating (Nielsen, 1994). Nonetheless, it is preferable to use this method in the early stages of the design, when the design is still on paper, so as to evaluate the proposed design.

According to several authors (Nielsen, 1994), (Allen et al., 2006), (Nielsen & Molich, 1990), (Nielsen, 1992), (Davids, Chikte, & Halperin, 2013), and (Davids et al., 2013), first, the heuristic evaluation method has been proven to predict more serious problems than other usability methods, such as the cognitive walkthrough method. Second, the heuristic evaluation method is capable of providing insights into how usable a design is. Third, the heuristic evaluation method can predict from 30 to 80 percent of the total usability problems existing in a design. Last but not least, the amount of time that the heuristic evaluation requires is less than that required by other methods, such as user testing methods.

In summary, the heuristic evaluation method is one of the user interface design methods, its main objective is to provide a usable software design for users (costumers). Similar to the interface design is document design. Document design is the field concerned with creating text that encompasses both words and pictures in a way that help people achieve their goals (Schriver, 1997). It is the process where writing and designing takes place. However, there is a lack of using the suitable methods and frameworks to support designers in designing public documents (Sless, 2004). Moreover, Shriver (1997) stated that "the science of document design comprises judging (what works) by examining the usability of the documents". Therefore, in this study we will use the heuristic evaluation method to help us explore the usability problems in the selected documents, as well as help us articulate those problems with the Gestalt principles of perception. Hence, a relation between the usability problems and the principles of Gestalt will be identified.

4.2.1 Heuristic evaluation procedures

In this phase, two expert designers[1] conducted the heuristic evaluation of the three public documents under consideration. One of these designers is an information designer with twenty-five years of professional experience in the field of information design. The evaluation was based on a set of commonly used heuristics derived from the work in (Nielsen & Molich, 1990) and (Davids et al., 2013). A proposed three-level framework model for the expert evaluation method was developed for this study, comprising the following levels: 1- exploratory reading, 2- comprehensive reading and 3- interactive reading, see table 4.1. A set of questions was developed under each of these levels to help in providing a detailed and accurate observation of the usability problems, encompassing all aspects from the design (how users see the document) to the literacy (how users read the document). Next, a template with the three-level framework model was given to the evaluators so that they can indicate the usability problem noticed in each document. The evaluators were given one week to evaluate each document. Then, each evaluator presented a written report based on the template provided with the usability problems found in each document.

[1] The two expert designers are the author of this thesis and her thesis supervisor.

Table 4.1: The proposed three-level framework model of a well-designed document

Heuristic	*Description*
1- Exploratory reading	
a. Visibility of the information	Viewers are able to identify the type of document, and the principle information in the document
b. Aesthetic and minimalist design	The document is compelling, and simply designed and structured
c. Accessibility of the information	Viewers can easily access the information they want
d. Intuitive visual layout	Elements are well-located in the document are well-perceived and visually attractive
2- Comprehensive reading	
a) Comprehensibility of the document	Readers are able to understand the document's purpose
b) Complexity of the information	The document's language is verbally clear, and well-written without any linguistic complexity
c) Relevance of the information	Readers find the information relevant
3- Interaction reading	
a) Motivation and encouragement	Readers are motivated to do the task asked in the document
b) Flexibility and efficiency of use	Readers find what they need easily and in a reasonable amount of time
c) Satisfaction and interaction	Readers are satisfied from the document, and are able to read it with self-confidence and without any frustrations

4.3 Phase 1-B: Document analytics employing Gestalt principles of perception

A document analytics is defined in this study as a qualitative research methodology where the documents are analyzed based on their design elements and principles. The purpose of performing this qualitative analysis is to evaluate the document's design from a graphical perspective. Here it is

important to mention that while this is a subjective field, where there are a few objective methods to evaluate the aesthetics of a document, certain elements and principles can still be detected if they were not applied properly and could have an impact on the general look of a document. Hence, in this method, we will use a precise way to measure the visual elements in each document using specific criteria based on the design elements and principles. In this way, we will analyze the design layout of the documents, specifically how the design elements, design principles and the Gestalt principles of perception were applied, focusing on how the information was presented and structured.

In order to perform the aforementioned analysis, we start by providing brief definitions of the design elements and principles that are used in designing any document. First, the design elements are the components or the parts that can be separated and defined in any visual design or in any piece of art. They are the tools of how a visual work is being structured, such as: line, shape, texture, value, color and type (DiMarco, 2010). Second, the design principles are the concepts or the guidelines used to organize the structural elements of a design. The design principles are: balance, alignment, repletion, proximity, hierarchy, contrast and space (Williams, 2008, Lidwell et al., 2010). The principles of design are a main attribute in the design of the structure of a document. In fact, the structure of a document has a big impact on how the document is being viewed and considered in the first place. In other words, documents that are well structured are more likely to be considered compared to documents that are poorly designed, irrespective of the importance of information they both carry. In addition to the design elements and the design principles, the Gestalt principles will also be considered in the defined document analytics. The Gestalt principles are the principles that address how our minds tend to perceive and observe elements around us. The Gestalt principles are: similarity, proximity, figure-ground relationship, uniform connectedness, good continuation and closure (for more explanation see chapter 3). Incorporating the Gestalt principles of perception in the document analytics phase will help us build a stronger analysis and also to address the competence of the principles in each document. Moreover, the Gestalt principles is a fundamental tool to use in building a coherent composition. Lastly, readers intend to evaluate the documents from the first sight and before they start reading them, thus, it is important to use the principles of perception as a measuring tool to analyze the quality of the design document.

4.3.1 Document analytic procedures

In this step, the researcher defined certain criteria based on the aforementioned design elements and principles to identify and observe the weaknesses in the design of the documents (if any). The defined criteria are: graphical style (the type used in the document), alignment (vertical and horizontal), the reading path[2], and the white/negative space. Additionally, an element was specifically defined for the purpose of the proposed document analytics named *blocks of information*. Table 4.2 presents the criteria and the elements used in the document analytics. Each of the criteria used in the document analytics was evaluated using the document's blocks of information according to the criterion's description. In addition to the aforementioned criteria, the Gestalt principles: similarity, proximity, figure-ground relationship, uniform connectedness, good continuation and closure were also evaluated. The Gestalt principles were evaluated according to their presence and application in the documents. Assigning each principle, a score from one to five for each block (with five representing a successful implementation of the principle). Based on the scores assigned for each block, an average overall score for the entire document is calculated for each principle. For example, the principle of proximity will be given a score of five if it were applied successfully and according to its definition on all the blocks in the document, and will be given a score of one if its application does not correspond to its definition for all the blocks in the document.

Table 4.2: The criteria and elements used in the document analytics

Criterion/element name	*Description*
Blocks of information	It is considered the main element that is used for analyzing all the other criteria and principles. It is defined as the area/space of the document that can be visually separated from its surroundings, and at the same time contains a single/one piece of information. It is shown as rectangular grey shape that is drawn on each text block of information that exist in the document, as shown in figure 4.4. Each block in the document is being measured, as well as, given a description according to the information it holds. These measurements will help us 1-

[2] Reading path is the way the text, or text plus other features, can determine or order the way that we read the document according to the arrangement of the words.

	understand how the information took place in the document, 2- find how much space of the document is being utilized.
Graphical style	The graphical style designates the typography used in each block. This criterion is used to identify the type used in each block compared to other types used in the document. Changes in the graphical style compared to the body text[3] will be counted and a total number will be given under the graphical style criterion.
Alignment	Vertical and horizontal alignment scores will be defined for each block of information. In order to do so, a line will be drawn tangent to the farmost left edge of the block to define its vertical alignment. Similarly, a line will be drawn tangent to the top edge of each block to define its horizontal alignment. Blocks with distinct alignment lines will be given an alignment score of 1. If more than one block shares the same alignment line, then the alignment score for each of these blocks will be the reciprocal of the total number of blocks sharing the alignment line. For example, if two blocks of information have one vertical alignment, then each of these blocks will be given a vertical alignment score of ½.
Reading path	The reading path is used to identify the sequence by which the blocks of information in a documents are seen. Starting from the top left corner of the document and moving towards the bottom right corner, each block in the document will be assigned a number in an ascending order to designate which blocks will be seen first and which will be seen last.
White/negative space	The negative space is the area that is not used in the document and will be identified when the total area of the blocks of information is subtracted from the total size of the document.

[3] The body text is "the main part of a printed text, excluding items such as headings and footnotes".

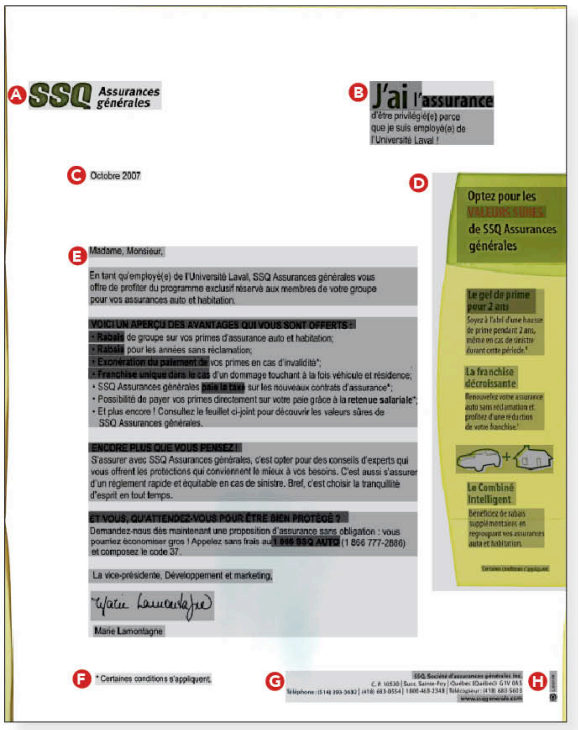


Figure 4.3: Blocks of information of an insurance company SSQ

4.4 Phase 2: The redesign

After exploring the usability problems, as well as analyzing the visual aspects in the documents and evaluating the Gestalt principles of perception and their presence, in this phase, we will provide "*an after"* version of the document employing the required Gestalt principles to enhance the document's usability. The document will be redesigned using the minimalist design approach (Davids et al., 2013).

The intention of the redesign phase is not to create a better or different version of the actual design, but to utilize the Gestalt principles as a tool to improve the design of the document. Hence, the changes in the document will be made according to the principle's description that could raise the document effectiveness and comprehensibility.

Chapter 5
Results and analysis

5.1 Introduction

Chapter four introduced the methodology proposed to firstly investigate the usability problems of public documents and secondly examine the application of certain design criteria in the design of public documents. The proposed methodology comprised the application of a heuristic evaluation method and a document analytics method on a sample of selected public documents. In this chapter, the results of the application of the proposed methodology on the selected documents are presented. Subsequently, using the Gestalt principles of perception, redesigned versions of the selected documents are developed to address some of the problems identified in these documents. The results presented in this chapter demonstrate how the application of the Gestalt principles of perception can improve the quality, usability and user understanding of public documents**.**

5.2 Findings of the heuristic evaluation method

The heuristic evaluation method is used in this work to assess the usability of the selected public documents and to identify their usability problems. To this end, expert evaluations of the selected documents were performed based on the three-level framework model described in chapter four. The findings of the heuristic evaluation method revealed over thirty usability problems in the two documents under consideration. Many of these usability problems were related to the layout design, which could have been caused by the improper application (or the lack thereof) of the design principles. Other usability problems had to do with the ease of document navigation and comprehension, which in turn had a big impact on the reader's perception of the information presented in the documents. In summary, while the design principles and methods should be well-applied and considered to solve design problems and improve designs, the usability problems revealed in these document show a lack of understanding of the user perception and cognition process accompanied by an improper application (or lack of application) of the design principles. The next two subsections detail and discuss the usability problems identified in the documents by the expert evaluators.

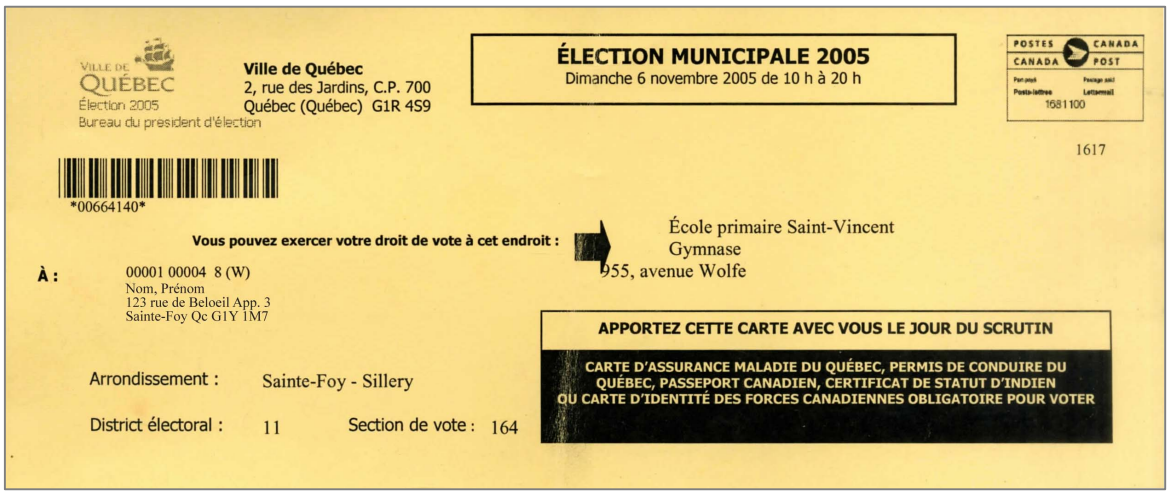


Figure 5.1: An election card for Quebec City in the year 2005

5.2.1 Usability problem of the Election card shown in figure 5.1:

The usability problem identified by the expert evaluators are listed below:

1. It is not easy to identify the genre of the document, especially for a user who has never voted before. Hence, the user has to commence reading the document in order to fully understand its purpose.

2. The document layout is poorly designed, as the arrangements of the blocks within the space lacks an actual grid that could construct the contents and support the structure of the document.

3. The general look-and-feel of the document does not seem very aesthetic.

4. A lack of organization and visual coherence can be detected from the first examination of the document, which affects the aesthetic judgment of the document.

5. The blocks of information seem to be designed and placed randomly without any consideration of the design principles.

6. The document lacks the visual hierarchy needed to help in guiding the user to start reading it, and to locate the important information in it.

7. The distribution of the negative-space does not support a well visualized layout.

8. The inconsistent use of the typographic elements negatively impact how the user envision the document.

9. The lack of proximity affects how quickly the user can correlate the information presented in the document.

10. It is challenging to grasp the point of entry as the information seems to be scattered all over the document. While locating the point of entry should normally be very simple for a document of this size, the lack of organization and the improper application of the design principles increase the time needed to find this information.

11. Several deficiencies in the graphic design of the document lead to visual weakening or even confusion. For example, it is it not normal to have the address of the city hall (secondary information) visually stronger than the identification of the voter (central information). Such deficiencies in the design have the effect of lengthening the consultation time needed to understand the document.

12. The undefined headings make it hard for the user to differentiate the important information from the rest of the information.

13. Printing errors (e.g., 955 Wolfe Avenue) induce a perception of amateurism in design.

14. The small amount of information and the small size of the document can cause a perceived sensation of relative simplicity at the first glance. However, with the arrangement of the elements in the document, as the reader starts reading the document this feeling of simplicity is lost. This may be confusing: first we think it's simple, but starting to read it the design ends up complicating things.

15. While the document is of a simple purpose (providing the information needed to vote), the document makes the overall process seem more complicated than it is in reality. Moreover, despite its complexity, the document has the potential of misleading the reader (e.g., no mention of what documents to bring to be able to vote).

16. Despite the fact that the action required by the reader is highlighted, there is still a risk of confusion due to the organisational problems in the document.

17. The lower the literacy level of the reader and her/his familiarity with the voting process in general are, the greater the risk of confusion by the document. Obviously, a better design of the document could reduce this risk and have the document have a better impact on the user, in particular by improving the groupings and reducing the number of graphic modalities.

18. A contact information is missing in case the user is confused or needs further information.

The list of usability problems identified by the expert evaluators reveals that the number of problems present in the document is considerably large, considering the size of the document. The identified problems can be attributed to two important design aspects: first, the improper (or lack of) application of the design principles. Second, and more importantly, the lack of applying a structured framework of information design. Each problem in the document can be correlated to a design principle that was not applied or was improperly applied. Additionally, the application of an information design framework can resolve the complexity in the document and transform it to a simple and easy to use document. For example, problems such as: 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11 showed a lack of a well-structured design and a lack of a grid based approach that supports the blocks of information, helps structure the design of the document and creates a clear reading path for the user. Also, the misuse of the graphic design affects the hierarchy of the document and creates a confusion while reading the document. The misuse of the graphic design elements affects the reader's attention towards the important information. For example, due to the disarrangements of the blocks the reader has to guess where to start reading as there is no focal point that dominate the layout in the area where the reader's eye naturally begins.

The Gestalt principles are concerned with user's perception and cognition. The application of the Gestalt principles can play a big role in enhancing this document's usability. Each of the usability problems identified by the expert evaluators can also be associated with one or more of the Gestalt principle. Problem 1 is related to the closure principle, where it is hard to identify the genre of the document. Problems 2, 5, 6, 14 and 15 are related to the principles proximity and good continuation, as they refer to a lack of structured grid and scattered elements. Problems 4, 9 and 10 are related to proximity and uniform connectedness, as they arise from a lack of organization and a mistreatment of the graphical elements. Problem 7 is related to the figure-ground relationship, as it arises from the distribution of the negative space in relation to the blocks. Problem 8 and 12 are related to the uniform connectedness, as they refer to the inconsistent use of the graphical elements and not applying it to the important information only. More on the relation of these problems to the Gestalt principles will be demonstrated in the redesign phase.

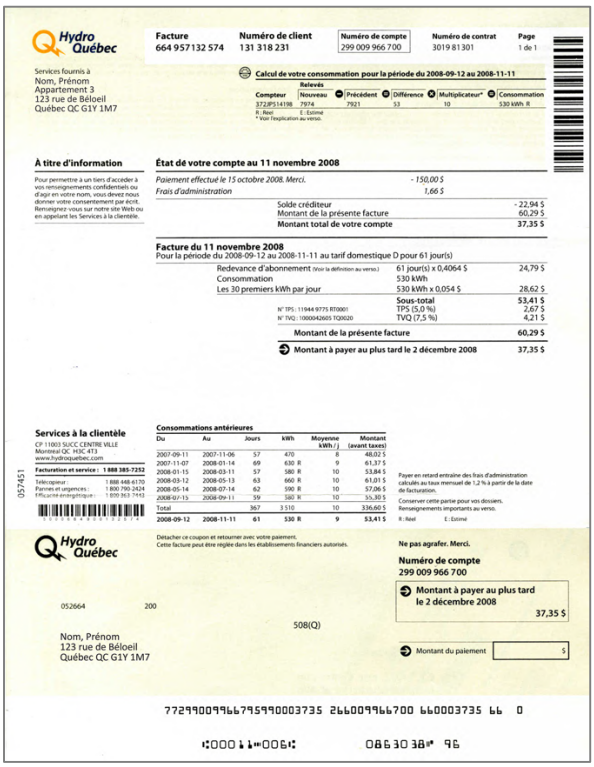


Figure 5.2: The electric bill of Hydro-Quebec

5.2.2 Usability problems of the Electric bill shown in figure 5.2:

The usability problem identified by the expert evaluators are listed below:

1. This document has the potential to project complexity to the user. The factors motivating the user to read this document are probably not related to its design. The user is likely to be motivated to read this document merely as it is an invoice and money is involved, rather than being motivated by the document's design.

2. The nature of this document as a bill filled with lots of information and numbers makes it hard for the user to find it attractive. Although there is the obvious presence of a thoughtful graphic grid, the design of this document is not compelling to the user.

3. In order to easily retrieve information, good visibility of info blocks could be improved.

4. The fact that this document has many vertical alignments requires more effort from the user to perceive all the information presented.

5. The lack of uniformity of alignments between the state account and the invoice block appears unjustified.

6. The use of the typographic elements including a variety of font sizes and the bold fonts used in every section of the document, encourage the eye to go everywhere in the document and not to follow an orderly clear reading path.

7. Visual hierarchy could be applied more effectively to improve the visual communication between the document and the user.

8. The user gets the impression of having to read everything to get an understanding of the organization of the bill.

9. The title levels and the design of the titles themselves do not seem optimal. The large amount of graphic grids (e.g. lack of neutral space) weakens the readability and easiness of finding information.

10. The reading path imposed by the design of the document is not very clear. There is a lot of distraction because of the multiple alignments. Better title management and block cutting would help without a doubt.

11. Depending on the user background, the time needed to fully understand the document can vary. However, the apparent complexity of the document may result in an incomplete use of the information presented in the document or a partial reading of the document. In order to avoid facing complexity, the user may simply decide to target only certain information (e.g. the amount to be paid at the bottom of the bill).

12. There are confusing and difficult to understand elements in the bill (e.g., the multitude of codes used to identify the account/person).

13. At the heart of the invoice there is a calculation grid. This calculation grid is not a simple static information but it is rather a calculation process. One may have the impression that the line amount to be paid at the end is simply the addition of all the preceding numbers aligned to the right. However, the sub-total, although visually linked, must not be added in this calculation line. This gives the impression that the calculation involved is more complicated than it actually is. For a consumer who is accustomed and who finds a balance Pay "normal", there is probably no problem.

14. For a first time users there is a potential for frustration (difficultly in understanding, difficulty in finding information, etc.), so the document is at least partially lacking. Besides the money stakes, the design of the whole document does not promote motivation. However, the motivation for the financial consequences is certainly a powerful engine, given the nature of the document (where you have to pay).

15. The presentation mode can also be helpful: when receiving a mail, the invoice is folded in an envelope setting. The payment slip (the name and address of the positioned for postal identification through the small plastic window of the envelope). The treatment of the parties is not equal in this respect. The slip itself has a certain degree of simplicity (not perfect however) compared to that of the computing grid which is more complex.

The usability problems that were identified in this document mostly arise due to the complexity of the information included in the document and due to the lack of applying a minimalist design approach. However, the genre of the document is clear and easy to be identified as a bill. Presenting irrelevant information along with the important information that must be included in the document results in the document's intricacy as well as user's confusion and frustration. Given that the genre of this document is an electric bill, the amount of important information and numbers in the document could be overwhelming (e.g., bill number, client's number, contract number, calculations of the user's consumption for the bill duration, etc.). Aside from the important information that must be included in the bill, there are other information presented randomly in the document that are of no added value to the user.

Usability problems 4 and 5 indicate that although there is a thoughtful designed graphic grid in this document, the number of vertical and horizontal grids used add complexity to the document. Additionally, it doesn't provide the user with a clear reading path, as there are many blocks of information to start with. Problem 6 indicates that the variety of the font sizes used in this document as well as the bold fonts used in many blocks of the document create a sensation of dispersion for the user while reading the document (a lack of focal point for the reader to focus on). Moreover, problems 11 and 12 indicate that the use of irrelevant information make the document difficult to read, as it requires more effort from the user to identify the important information. In regard to the Gestalt principles of perception, problems 4, 5 and 9 are related to the principle of good continuation, as they refer to the document grids and the several alignments. Problems 6 and 7 are related to the uniform connectedness, as they are related to the application of the graphical

elements. Lastly, problem 10 is related to the proximity and good continuation, as it refers to the alignments of the document and the lack of a clear reading path.

5.3 Findings of the document analytics method of the election card

The document analytics method uses precise measurements of the visual elements in the documents to derive a set of data about the design of each document under consideration. The derived data sets provide a functional base which can be employed to examine the effectiveness of the documents design as well as to identify how the design principles were implemented in these documents. Additionally, this data enables the detection of the design flows in the documents in a systematic way. The data sets are also analyzed in a rigorous way in order to create reliable and substantiated statements in regards to how the documents are perceived by users. For instance, showing how many graphical changes were made in a document can provide us with insights of how complex or simple a document could be.

Before reviewing the results of the document analytics method, we will start by providing the specifications of the election card document in terms of its measurements and the details of each block of information it contains. Understanding the document's size and how the blocks of information are configured is important in this stage, as it will help in better understanding the results of the document analytics method as well as how the document layout is being utilized. Moreover, the description provided by these measurement (e.g., the actual size of the document) helps in putting the obtained results into perspective. For example, a small document containing a number "X" of alignments might be more complex compared to a larger document containing the same "X" number of alignments. Figure 5.3 depicts the blocks of information included in the election card. Table 5.1 presents detailed information about the blocks of information included in the election card, in terms of how many blocks, the description of each block, the size of each block, the percentage that each block area represent of the overall blocks area, and the percentage that each block area represent from the overall document area. Table 5.2 provides the specification of the election card, in terms of its length, width, area, and white space percentage.

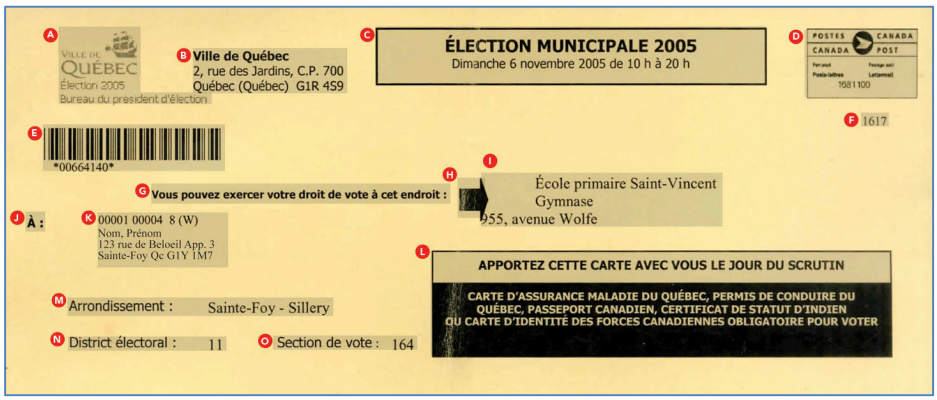


Figure 5.3: The blocks of information of the election card

Table 5.1: Blocks specification for the election card document

Block's specifications							
Block's number	**Block's name**	**Description**	**Block's width (cm)**	**Block's height (cm)**	**Block's size (cm2)**	**Percentage of the block from total blocks (%)**	**Percentage of the block from the whole document (%)**
1	A	Logo	2.17	1.73	3.75	5.17	1.98
2	B	Address	3.56	1.11	3.93	5.41	2.08
3	C	Text	9.00	1.31	11.79	16.24	6.23
4	D	Logo	2.52	1.65	4.16	5.73	2.20
5	E	Bar code	4.18	1.02	4.26	5.87	2.25
6	F	Number	0.58	0.35	0.20	0.28	0.11
7	G	Text	6.82	0.28	1.90	2.61	1.00
8	H	Graphic sign	0.76	1.02	0.77	1.06	0.41
9	I	Text	5.38	1.23	6.59	9.08	3.48
10	J	Text	0.39	0.38	0.15	0.20	0.08
11	K	Text	2.98	1.33	3.96	5.46	2.09
12	L	Text	10.63	2.47	26.30	36.22	13.90
13	M	Text	6.01	0.40	2.40	3.31	1.27
14	N	Text	3.54	0.35	1.22	1.68	0.65
15	O	Text	3.27	0.38	1.23	1.69	0.65
					72.62	**100**	**38.37**

Table 5.2: Specification of the election card document

Document length	**8.87 cm**
Document width	**21.34 cm**
Document Area	**189.24 cm^2**
Percentage of white space in the document	**61.63%**

Based on the criteria and elements introduced in chapter 4 (blocks of information, graphical style, alignment (horizontal and vertical) and the white/negative space), the results of the document analytics method for the election card are presented in Table 5.3. Considering the small size of the election card, the results in Table 5.3 demonstrate that there are many concerns with this document. First, there are 15 blocks of information, with each block representing a different piece of information. Second, there are 14 graphical changes in this document, including font style, font type and font size, this indicates that viewer's eye is drawn to all the blocks and there is no focal point that direct the reader's eye. Third, there are a total of 25 vertical and horizontal alignments used in this document. The large number of alignments employed in the election card shows a poor design layout as well as a lack of an actual grid. Proper alignment can make the document visually more appealing and help the viewer in better perceiving and scanning the document. Moreover, creating good alignment helps placing the elements in the design and avoid overlapping blocks in the documents as well as help in avoiding the gap between the blocks, as shown in figure 5.4, the overlapping of block (A-B), (H-I) and the gap between block (J-K). Figure 5.5 show the reading path for the election card as determined based on the criteria defined in chapter four.

Table 5.3: The results of the document analytics of the election card

Document's name	The criteria and elements used in the document analytics				
	Blocks of information	Graphical style	Alignment		White/negative space
			vertical	Horizontal	
Election card	15	14	14	11	61.63%

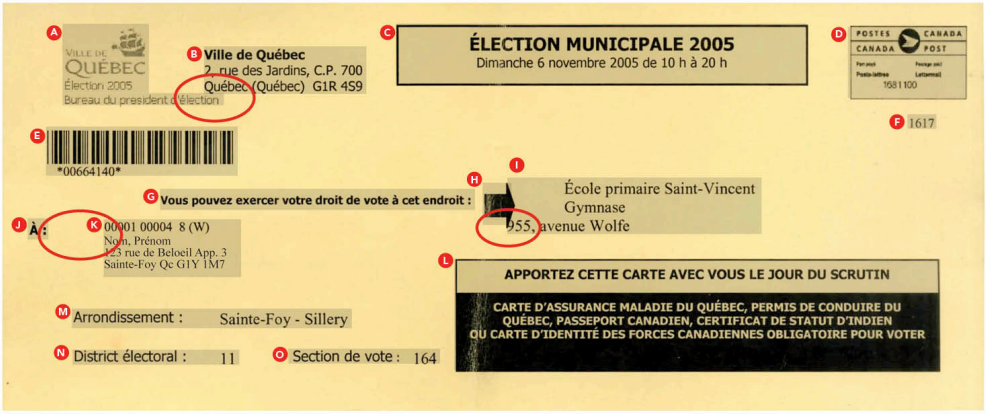


Figure 5.4: The overlapping and the gaps of the blocks

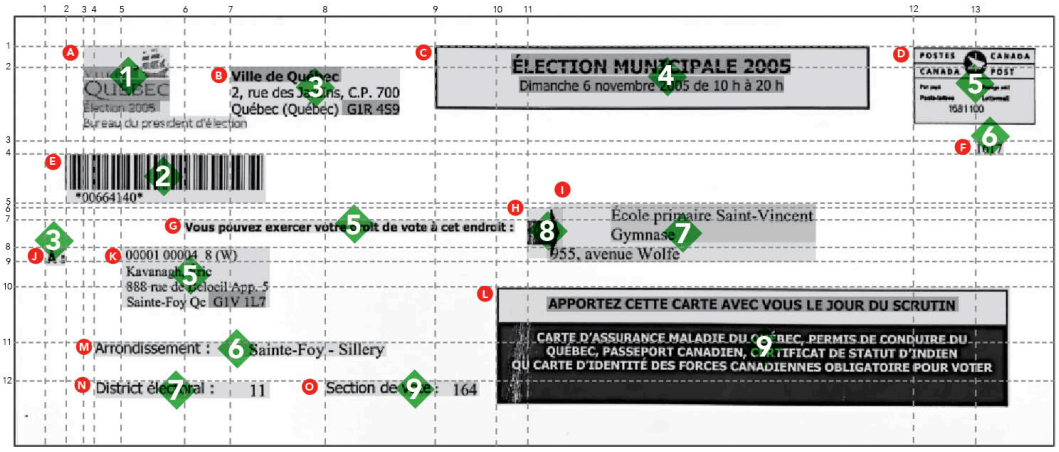


Figure 5.5: The reading path for the election card

Table 5.4: The results of the Gestalt principles of perception of the election card

The Gestalt Principles of perception					
Similarity	**Proximity**	**Figure-Ground Relationship**	**Uniform connectedness**	**Good continuation**	**Closure**
2.33	**3.87**	**4.33**	**2.53**	**2.67**	**2.33**

Table 5.4 presents the overall score pertaining to each of the Gestalt principles (similarity, proximity, figure-ground relationship, good continuation and closure), a descriptive table with the score of each block separately is included in the annex. The Gestalt principles scores shown in table 5.4 demonstrate a low existence of the Gestalt principles in the document. Before we start explaining these results, it is important here to highlight that there is some subjectivity associated with the scores assigned to the Gestalt principles, meaning that results could vary from one evaluator to another. However, the document and block specifications were taken into consideration when scoring the Gestalt principles, so as to provide objective results as much as possible. Starting with the principle of similarity, as defined earlier in chapter 3, "*it is the intention to perceive similar elements together based on their features*". Similarity is a principle that helps organize the element in the document and helps the viewer perceive the related information easily and in a short period of time. The score calculated for this principle was found to be 2.33 for this document as calculated per the methodology described in chapter 4. The low score for this principle reflects the fact that

this principle is not well-utilized in the document. It can be seen that each block in the document has been treated graphically differently, whether in the font style, type or size. This creates inconsistency in the design and un-relatedness between the visual elements of the document. Furthermore, there are no similar blocks in this document that share the same features except for the type colour. Next, comes the principle of proximity, for which the calculated score was found to be 3.87. As shown in figure 5.1 the information inside each block is grouped together except for blocks (M-N). For blocks (M-N), there is a slight gap inside the block itself which somehow disconnect the information. Furthermore, while blocks (J-K) are related to each other, they are placed far from each other which emphasis the lack of relationship, and also demands an additional effort from the reader to visually connect the related information. Lastly, when we take a look on the entire document we will notice an obvious lack of proximity between the blocks in the overall layout, which was the reason for the respective usability problems. It is important to mention that even blocks that are unrelated to each other should be well-organized, placed wisely and according to a specific grid that guides the reader's eyes in the intended direction. Moreover, a good placement of elements (blocks) creates an even distribution of the white space or the background which affects the reader's perception. This leads to the next principle, which is the figure-ground relationship. The score calculated for this principle was found to be 4.33. While, every block in the document is identified from its background, blocks (H-I) are overlapping. The score for the principle of uniform connectedness was calculated to be 2.53. As mentioned in chapter three that "*elements that share same visual properties (such as color) are perceived to be more related than elements that do not share same visual properties*", as shown in figure 5.1, most of the blocks don't share visual properties. Each block was almost treated graphically in a different way, which creates disconnection between the blocks and lack of hierarchy. As stated in Palmer & Rock, 1994 that the principle of uniform connectedness plays an important role of providing an entry-point through the elements of perceptual organization. The score for the good continuation principle was calculated to be 2.67. This principle is concerned with how elements are arranged whether in a straight line or a curved line. In our case it is associated with the alignments of the blocks. Figure 5.5 demonstrates a total of 15 blocks with 14 vertical alignments, which is considered numerous for such a small document. A good continuation principle helps the reader's eye navigate naturally through elements as well as helps directing attention to specific elements or information. The last principle is closure; whose score was calculated to be 2.33. This score indicates that there is a concern when perceiving each block on its own as well as the entire document. As stated earlier in the usability problems, the

document appears complex while it is not. It is hard to identify the genre of this document and the way the document is organized makes it hard for the reader to perceive it successfully. Closure is an essential principle that helps reduces complexity to convey visual information and making layout more engaging for readers.

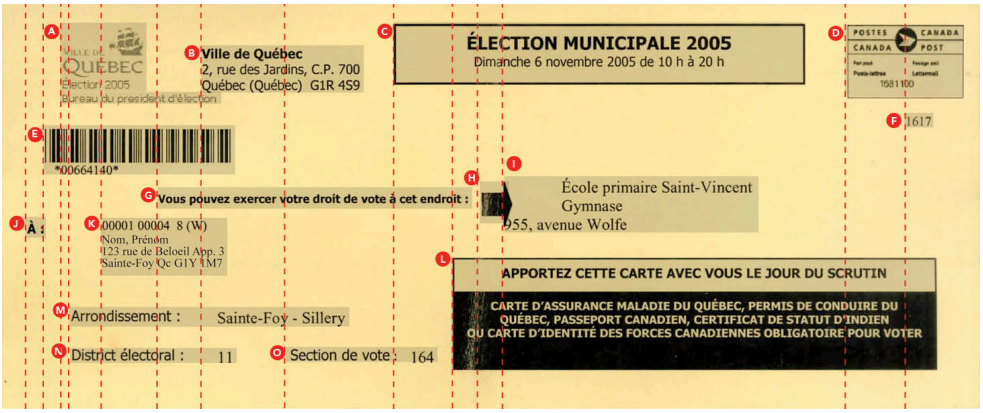


Figure 5.6: The vertical alignments of the election card document

After reviewing the results of this method, it is clear that it revealed serious problems that could have an impact on how the user perceives, reads and understands the document. Furthermore, analyzing the Gestalt principles similarity, proximity, figure-ground relationship, good continuation and closure showed that there is a lack in utilizing these principles in designing the document, which could be the reason of having numerous usability problems in the documents. Therefore, in the next phase a redesigned version of the document will be presented after applying certain Gestalt principles that could improve the document usability.

5.4 Redesign of the election card

The results of both the heuristic evaluation method and the document analytics method revealed serious problems in the election card document. These problems could influence how the user perceives, reads and understands the document. Hence, in this subsection redesigned versions of the election card are presented to demonstrate how the use of the Gestalt principles can resolve some of the identified problems in the document. Several redesigned versions of the election card are developed to show the application of the Gestalt principles one at a time in the election card document. The use of several redesigned versions, with each version only implementing one Gestalt

principle at a time, enables an understanding of how the changes made to the document to implement each principle impact the overall document. Each of the aforementioned redesigned versions is presented and compared with the original election card document in a separate figure in order to enable an easy visualization of the changes made to the document to implement the respective Gestalt principle. Afterwards, a final version is presented to show the application of all the Gestalt principles simultaneously.

Proximity

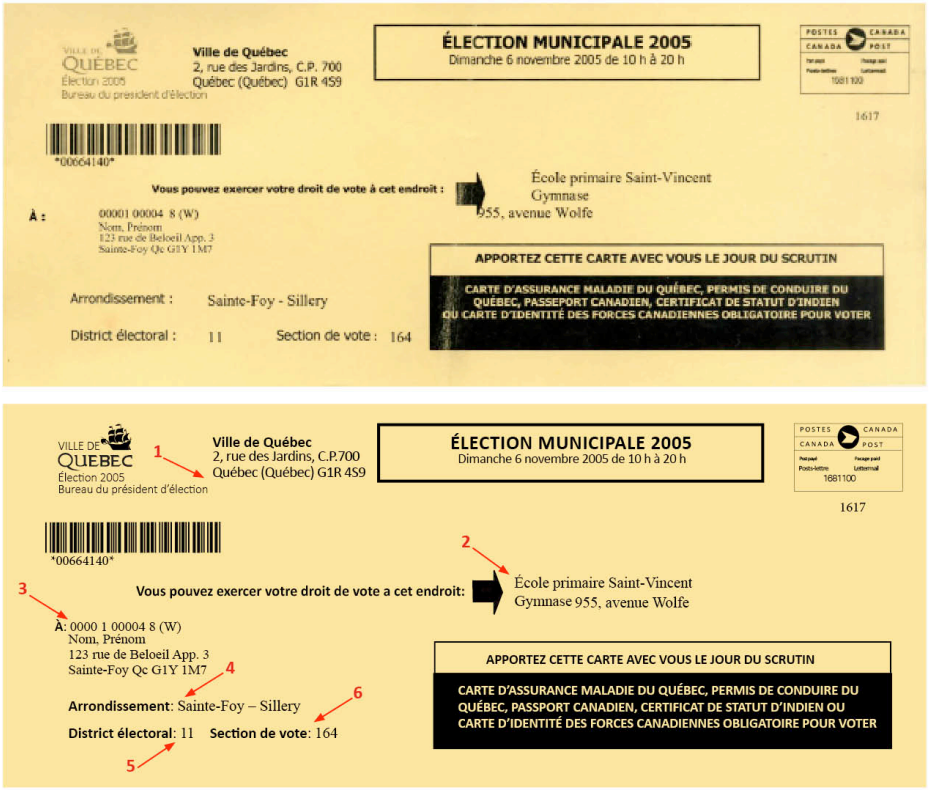


Figure 5.7: The redesign of the election card with the application of the proximity Gestalt principle

Figure 5.7 presents the redesigned version of the election card after the implementation of the proximity principle. As mentioned earlier in chapter three, grouping pieces of information by bringing them in close proximity in the document layout enable an easy identification of the conceptual relationships between them. Oppositely, when pieces of information are placed far apart in the document layout it is easier to perceive their un-relatedness. In order to employ this principle, the election card was revised to have proximity reflect the association of information. In figure 5.6, the changes made to implement the proximity principle are marked with red arrows and numbered

from 1 to 6. Changes 3, 4, 5 and 6 bring elements together to show their relation and changes 1 and 2 place elements further apart as they are not conceptually related to each other.

The second redesigned version employs the Gestalt principle of similarity. As discussed in chapter three, the similarity principle is related to how our minds tend to group similar elements together and how our minds encourage us to connect related information together as long as they have a similar look. In document design, fonts and alignments can play an important role in the implementation of the similarity principle. Figure 5.8 highlights, by red arrows and numbers, the changes made to the election card to implement the principle of similarity. In change 3, the font type in blocks J and K was changed to be similar to the blocks below them (blocks M, N, and O). Furthermore, block J was vertically aligned with blocks M and N. Similarly, in changes 1, 2, 4, 5 and 6 font types were changed to be made similar to the fonts used in the rest of the document.

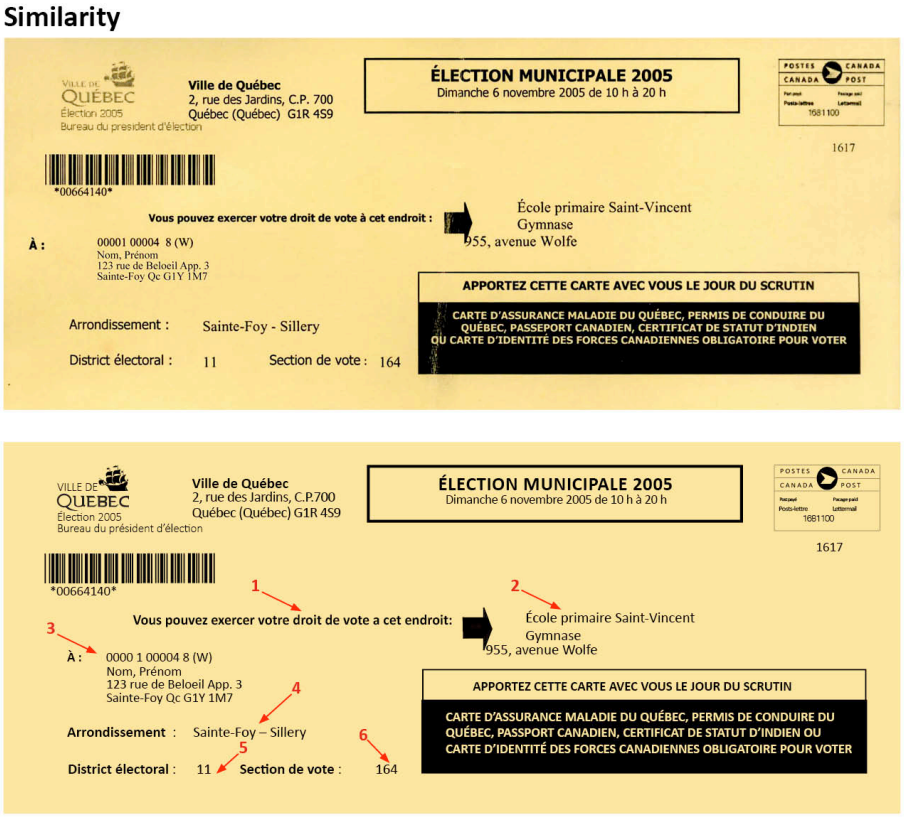


Figure 5.8: The redesign of the election card with the application of the similarity Gestalt principle

Figure 5.9 shows the redesigned version of the election card to implement the Gestalt principle of uniform connectedness. This principle is concerned with the relatedness, as described in chapter 3, meaning that elements that share the same visual properties and are visually connected are perceived as connected compared to those elements that do not. This principle can be used to create a visual hierarchy in the document by relating together information having the same level of importance. In change 1, the font size is decreased to show that city hall address information is secondary and to disconnect it from the other important information having large font size. In change 2, the font size of the election date is increased to emphasize it relationship with the election title above it. In change 3 and 4, the font sizes are changed to emphasise the importance of the election location by making it of large font size (so as to relate it with other important information in the document having similar large font size), and change 4, the address is connected together sharing the same alignment. Changes 5, 6, 7 and 8 create uniformity and relatedness between the voter information by unifying the typeface.

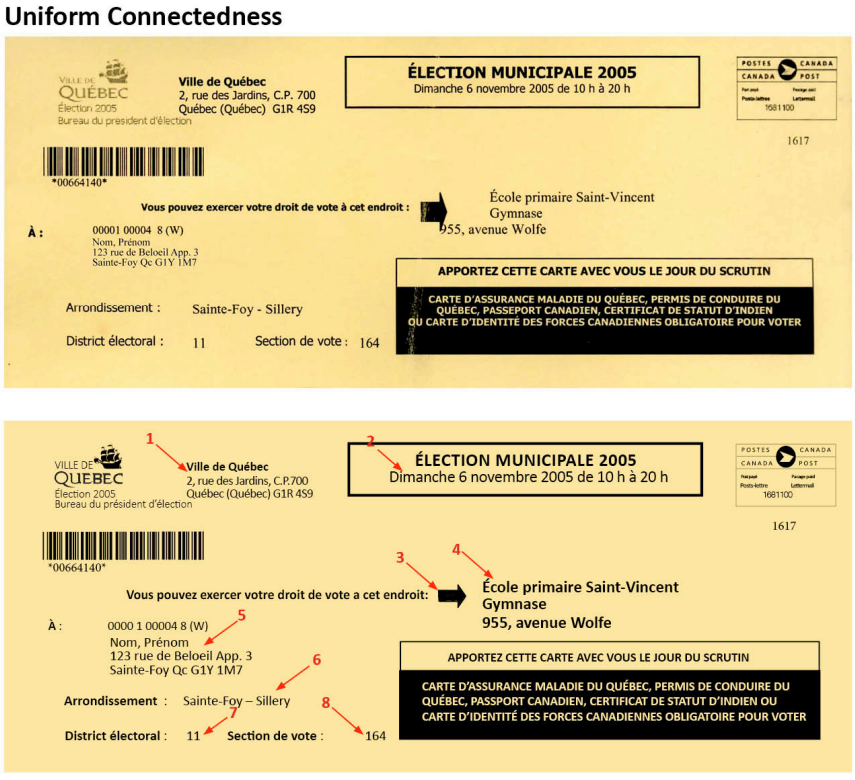


Figure 5.9: The redesign of the election card with the application of the uniform connectedness Gestalt principle

The next version of the redesigned election card is concerned with the implementation of the Gestalt principle of good continuation. The good continuation principle indicates that visual elements sharing the same line or curve are perceived as more related. This principle help connects the visual element in a document and forms the base to enable the identification of where the information should be placed. The use of this principle enable the creation of a grid structure to support the information design in the document. Figure 5.10 shows the implementation of the good continuation principle in the election card by reducing the number of alignments in the document. Reducing the number of alignments forms continues lines that help the reader navigate easily through the document. As can be seen in figure 5.9 reducing the number of alignments creates a clear grid that reduces the complexity in the document.

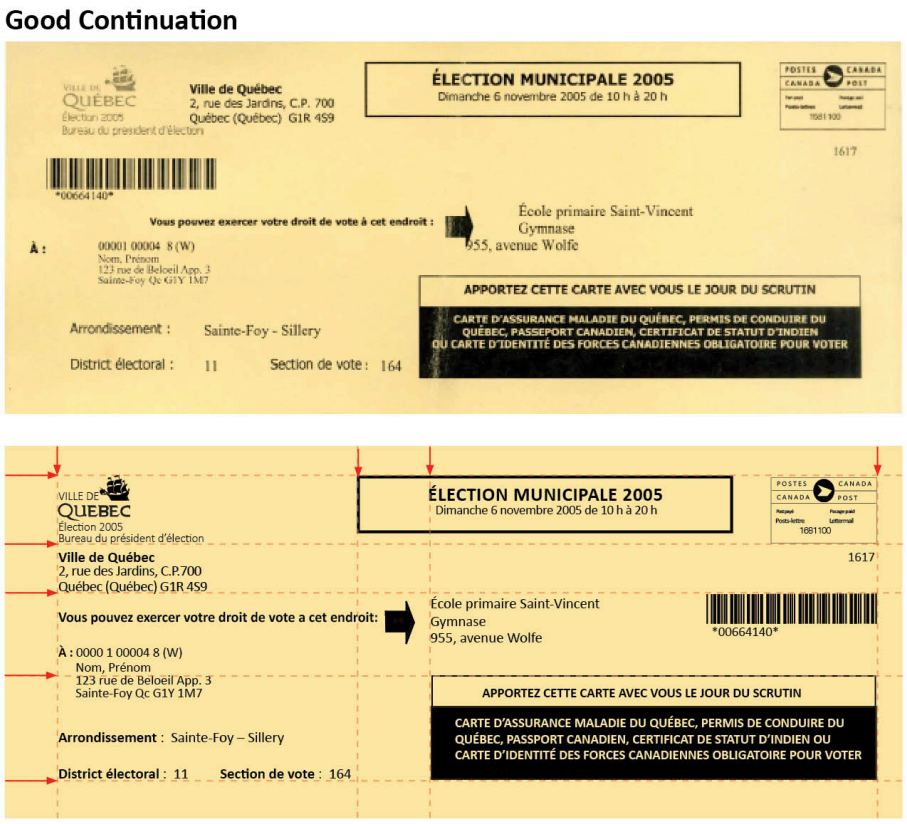


Figure 5.10: The redesign of the election card with the application of the good continuation Gestalt principle

Finally, figure 5.11 presents a redesigned version of the election card with the simultaneous application of all the Gestalt principles discussed before. As can be seen in figure 1.10, applying proximity, similarity, good continuation and uniform connectedness using the minimal approach have improved the document's layout as well as the visual organization of the document. For example, the number of vertical alignments is being reduced from 14 to 5, the graphical changes are minimized to reduce complexity and finally the document now has a well-structured grid that supports the blocks of information.

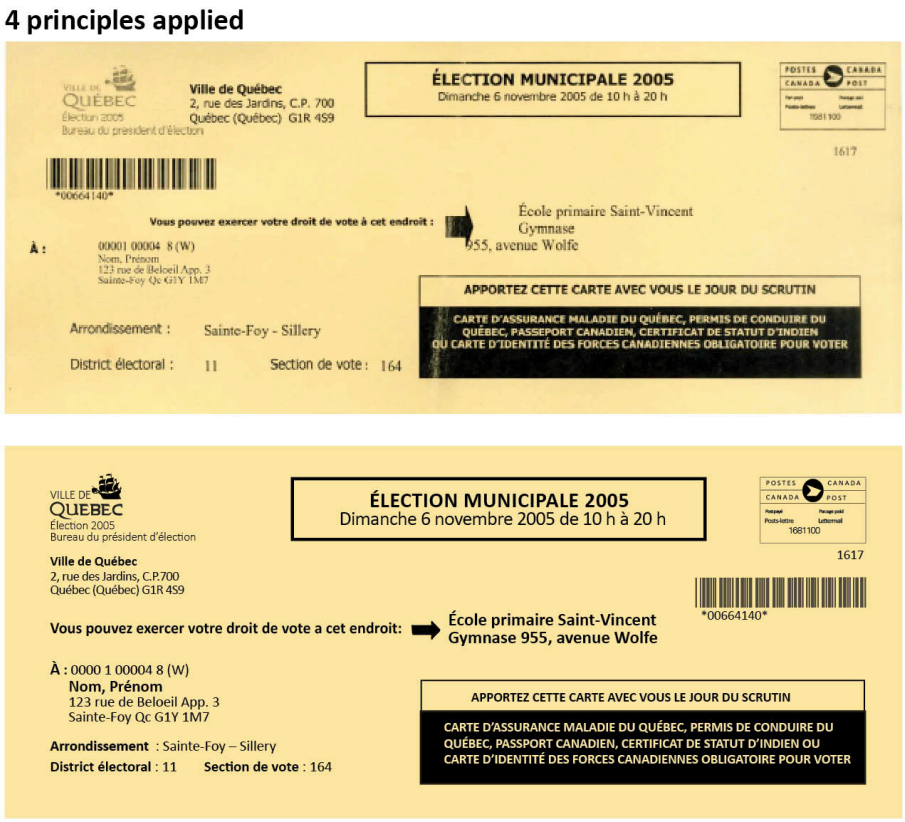


Figure 5.11: The redesign of the election card with the four principles applied

5.5 Document analytics results of the Electric bill

Figure 5.12 depicts the blocks of information included in the electric bill document. Table 5.5 presents detailed information about the blocks of information included in the electric bill, in terms of how many blocks, the description of each block, the size of each block, the percentage that each block area represent of the overall blocks area, and the percentage that each block area represent from the overall document area. Table 5.6 provides the specification of the electric bill, in terms of its length, width, area, and white space percentage.

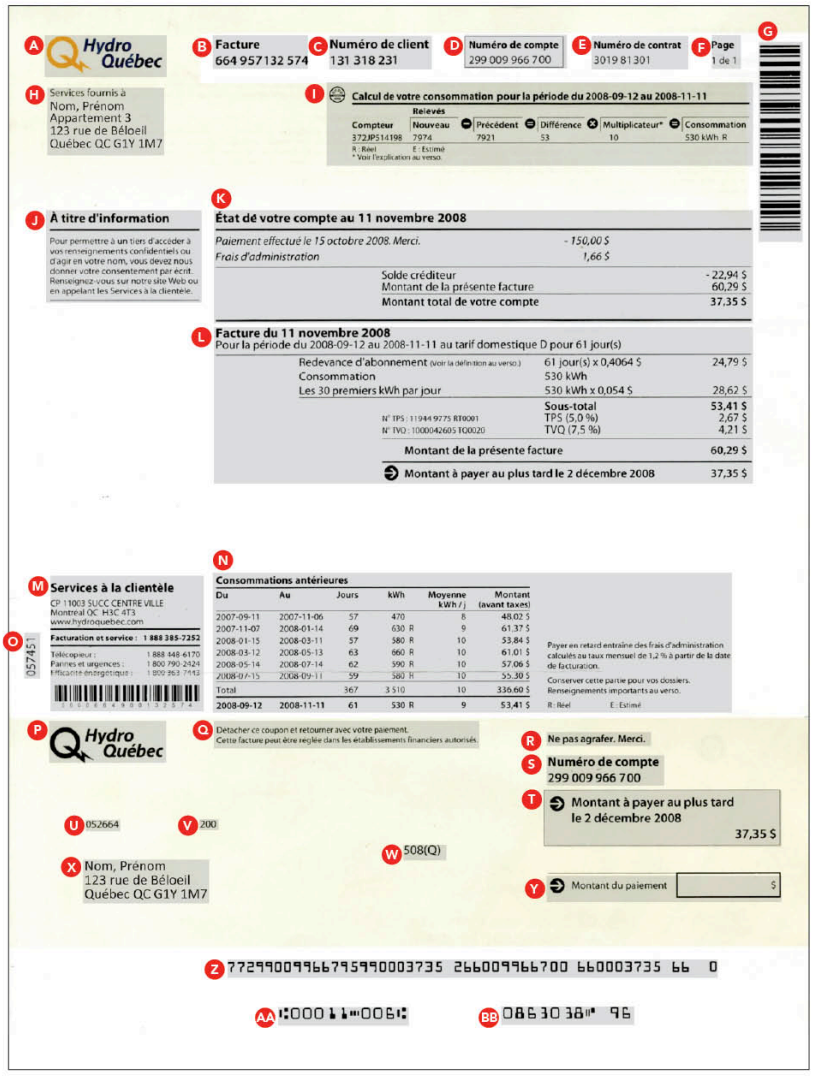


Figure 5.12: The blocks of information of Hydro Quebec electric bill document

Table 5.5: Block specification for the Hydro Quebec electric bill document

Blocks specifications							
Block's number	**Block's name**	**Description**	**Block's width (cm)**	**Block's height (cm)**	**Block's size (cm2)**	**Percentage of the block from total blocks (%)**	**Percentage of the block from the whole document (%)**
1	A	Logo	3.18	1.08	3.41	1.30	0.58
2	B	Text	2.70	0.88	2.36	0.90	0.40
3	C	Text	2.80	0.88	2.45	0.93	0.41
4	D	Text	2.64	0.88	2.31	0.88	0.39
5	E	Text	2.45	0.78	1.90	0.72	0.32
6	F	Text	0.83	0.78	0.64	0.24	0.11
7	G	Par code	1.13	5.15	5.79	2.20	0.98
8	H	Text	3.10	1.66	5.15	1.96	0.87
9	I	Text	11.30	2.08	23.49	8.93	3.98
10	J	Text	4.08	2.48	10.10	3.84	1.71
11	K	Text	14.35	3.04	43.55	16.56	7.37
12	L	Text	14.35	4.17	59.77	22.73	10.11
13	M	Text	4.13	3.53	14.54	5.53	2.46
14	N	Text	13.85	3.64	50.38	19.16	8.52
15	O	Text	0.48	1.03	0.49	0.19	0.08
16	P	Logo	3.18	1.09	3.45	1.31	0.58
17	Q	Text	7.05	0.54	3.83	1.46	0.65
18	R	Text	2.75	0.37	1.02	0.39	0.17
19	S	Text	3.13	0.82	2.57	0.98	0.43
20	T	Text	6.28	1.51	9.50	3.61	1.61
21	U	Number	1.00	0.36	0.36	0.14	0.06
22	V	Number	0.63	0.28	0.17	0.07	0.03
23	W	Number	0.96	0.33	0.31	0.12	0.05
24	X	Text	3.14	1.18	3.70	1.41	0.63
25	Y	Text	6.35	0.63	3.97	1.51	0.67
26	Z	Number	13.08	0.35	4.58	1.74	0.77
27	AA	Number	3.53	0.45	1.59	0.60	0.27
28	AB	Number	3.53	0.45	1.59	0.60	0.27
					262.96	**100**	**44.50**

Table 5.6: Specification of the Hydro Quebec electric bill document

Document length	**27.60 cm**
Document width	**21.41 cm**
Document Area	**590.92 cm^2**
Percentage of white space in the document	**55.50%**

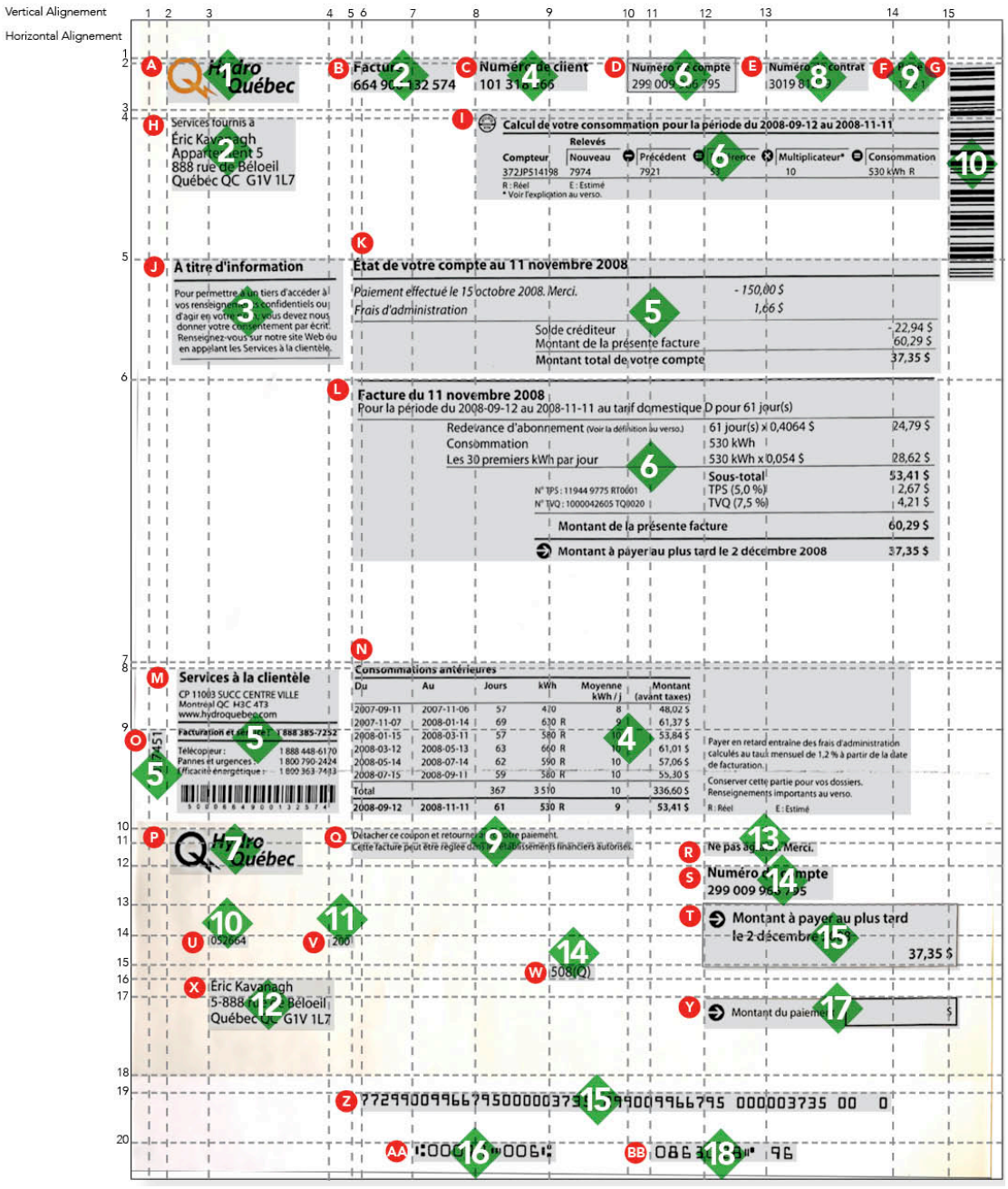


Figure 5.13: The reading path for Hydro Quebec electric bill document from the top left

Table 5.7: The results of the document analytics of Hydro Quebec electric bill

Document's name	The criteria and elements used in the document analytics				
	Blocks of information	Graphical style	Alignment		White/negative space
			vertical	Horizontal	
Hydro Quebec electric bill	28	24	15	19	55.50%

Before we start commenting on the results presented in table 5.7, it is important to highlight the particularity of this type of document (being an electric bill) and the specific type of information it holds. As we mentioned before, that the information presented in this document is mostly numbers and calculations for electricity consumption. In this work, we are only concerned with the document layout and design and we do not attempt to comment on or propose changes to the information content of the document. The reason for this is that the utility is obligated to include certain information in the bill due to specific laws and regulations involved, and the determination of which information is required by law and which is not is beyond the scope of this work. The results in the table 5.7 showed how complex the document design is due to the number of blocks which is 28, the large number of graphical changes in the document which is 24 and the number of alignments rising to a total of 29 vertical and horizontal alignments. These results reveals that although this document has a thoughtful grid, the placement of the information blocks and the various type changes have made the document difficult to understand. Figure 5.13 show the reading path for the electric bill as determined based on the criteria defined in chapter four.

Table 5.8 presents the overall score pertaining to each of the Gestalt principles (similarity, proximity, figure-ground relationship, good continuation and closure), a descriptive table with the score of each block separately is included in the annex. As shown in table 5.8, the scores calculated for the Gestalt principles in this document are not high on average. Starting with the principle of similarity, for which the calculated score is 2.64. Figure 5.12 shows that there are so many variations in the information blocks font style and size. Moreover, inside each block there are various graphic changes. The dissimilarity shown in the document could affect the reader's perception towards the document and could require longer time from the reader to understand the document. Secondly, the score for the proximity principle was calculated as 4.46. This relatively high score reflects that the document has certain grid that structured the blocks. All blocks are well-grouped with their related information. Thirdly, the figure-ground relationship principle has a

calculated score of 4.5. This relatively high scores can be understood given that all the blocks are identifiable and recognizable from their respective backgrounds. Forth, the score calculated for the principle of the uniform connectedness is 3.21. This score arises due to the various graphical changes done in the document, for instance font sizes of 7, 8, 9, 10 and 11 were used, as well as original, bold and italic typefaces. Moreover, the use of horizontal lines with different thicknesses has affected the document appearance. Fifth, the score calculated for the principle of good continuation is 3.21. This score reflects the large number of alignments as well as the number horizontal lines (which is an important element utilized in this document to subdivide the information). The last principle is closure, for which the calculated score was 2.86. In summary, the study of the electric bill using the heuristic evaluation method and the document analytics method, have provided insights on which Gestalt principles could be used to improve the document usability and understanding, which will be done in the next subsection.

Table 5.8: The results of the Gestalt principles of perception of Hydro Quebec electric bill

The Gestalt Principles of perception					
Similarity	**Proximity**	**Figure-Ground Relationship**	**Uniform connectedness**	**Good continuation**	**Closure**
2.64	**4.46**	**4.5**	**3.21**	**3.21**	**2.86**

5.6 Redesign of the Hydro Quebec electric bill

In this phase, we will develop redesigned versions of the electric bill with the application of certain Gestalt principles. First, we will start by applying the proximity and similarity principles. Figure 5.14 gives the redesigned version with the application of these principles. In figure 5.14, change 1 is that we removed the gradient bar that was located on the top tier of the document and we had the text on a white background. The reason behind this is: 1) to create separation between the top gradient bar and the bottom as in the original document they are perceived to be together due to their colour similarity, while they are not, 2) to add more emphasises on the lower part of the document that has a gradient, as it carries more important information. Change 2 is that we grouped the information together by reducing the space between them. Change 3 is grouping the below text together as they are similar in their type. Last change no.4 is placing and grouping the three codes together.

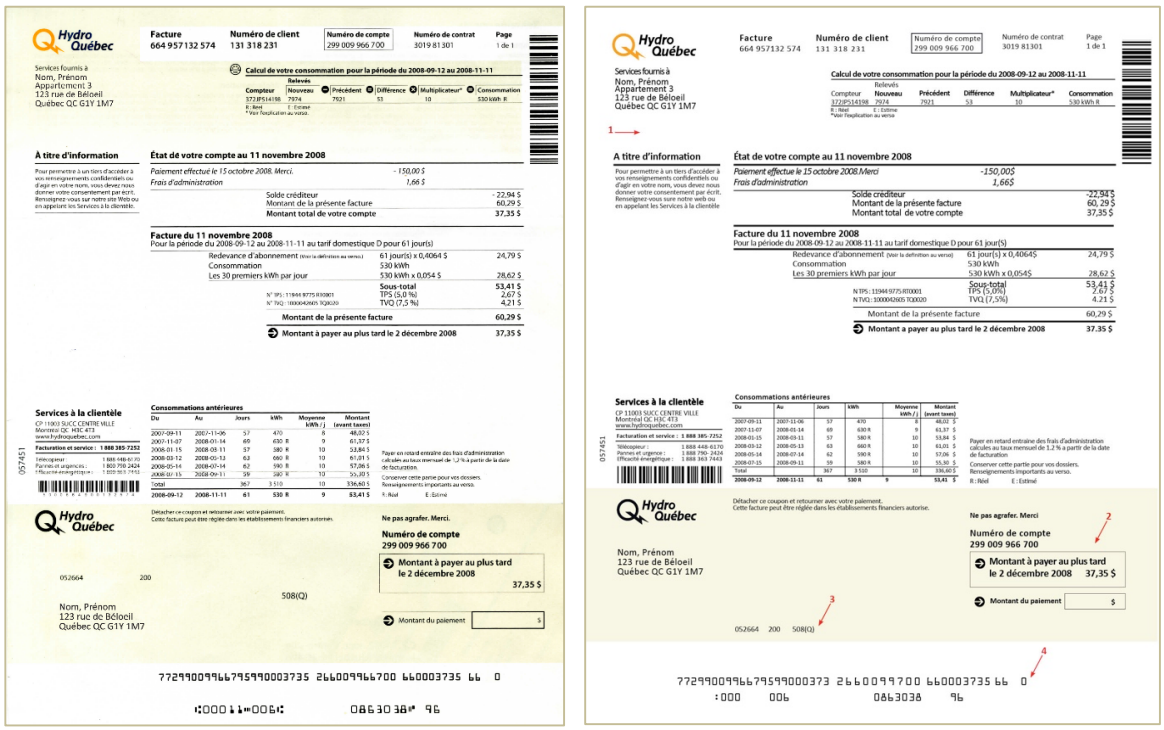


Figure 5.14: Hydro Quebec electric bill with the proximity and similarity principles applied

The second principle applied is the good continuation principle. As for the election card, this principle is concerned with the alignments in the document. Given the amount of information presented in this document, it is difficult to align the blocks of information using few alignments. However, we tried to minimize the number of alignments of the blocks and create a good continuation. Accordingly, there are four main changes made to apply this principle as shown in figure 1.15. Change 1 is placing the entire block of the calculation to the left, so that it will be aligned with the most of other blocks shown beside the doted red line. Change 2 is concerned with the lines inside the block that indicate the state of the account. As shown on the left figure (the original bill), in the state block the continuity is interrupted through the use of lines between information. Removing these lines as shown in the right figure could improve the understanding through continuity. Change 3 and 4 are also placement of the blocks so as to be aligned with the principle red doted line.

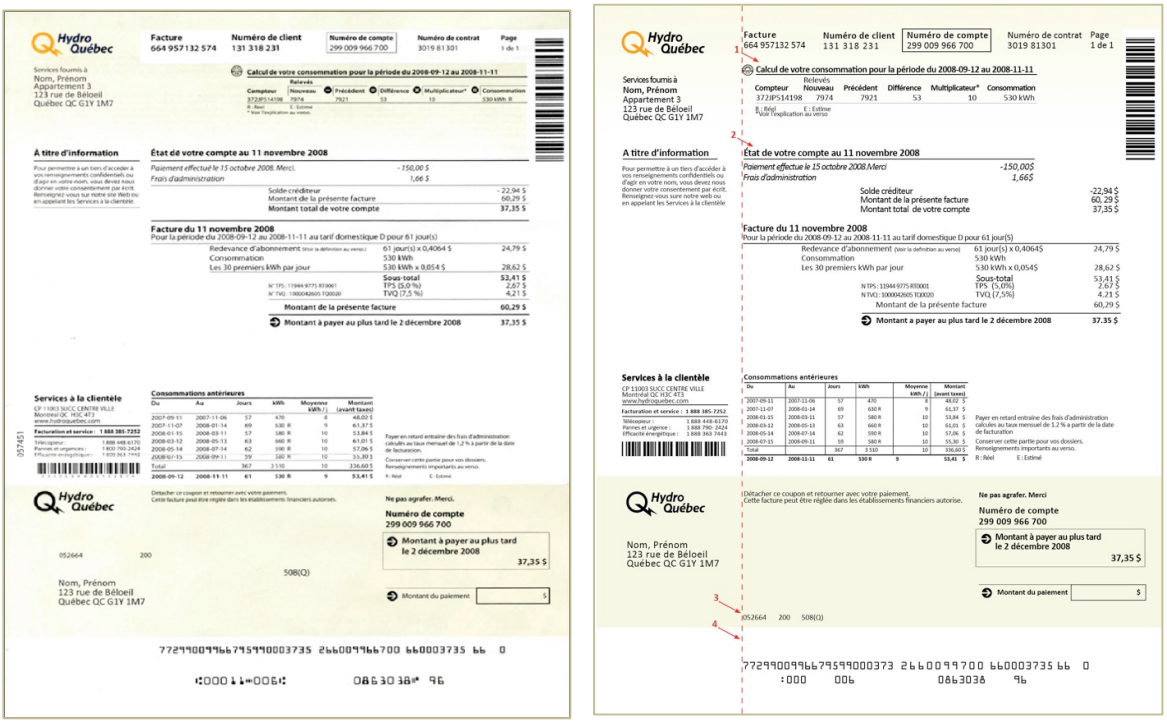


Figure 5.15: Hydro Quebec electric bill with the good continuation principle applied

The third principle applied is the uniform connectedness principle. To apply this principle in this document, we worked on the font and its size. Minimizing the differences in the font size is an essential key for reducing complexity of the document. It helps the reader to easily differentiate between the important information which are designed in a bigger font and the less important information which are designed with a smaller font. Moreover, it creates unity within the block itself. We have noticed while redesigning this document that a lot of changes regarding the font style and size within the same block which might demand unnecessary cognitive effort from the reader. Hence, in figure 5.16 we made 10 changes mainly regarding the typographic elements. We have minimized the number of font size that are used in this document as shown in the right figure, changes 2, 3, 4, 5, 6, 7, 8, 9 and 10. By increasing the font size particularly in the important information or the information that the user might be interested in could increase the ease of the document and encourage the reader to read the entire document and not only the amount of payment he/she should pay. Moreover, it could increase the comprehensibility of the information. We have limited the area shaded on the top of the document as shown in change no.2 so it incorporates only the Hydro Quebec logo and the user's information as well as to emphasis the existing column on the

left that was already designed in the original grid. In this case, it should relate to the lower rectangular beige bar on the bottom of document as it also incorporates the same information. Hence, the user will perceive the two coloured area together as they carry the same information.

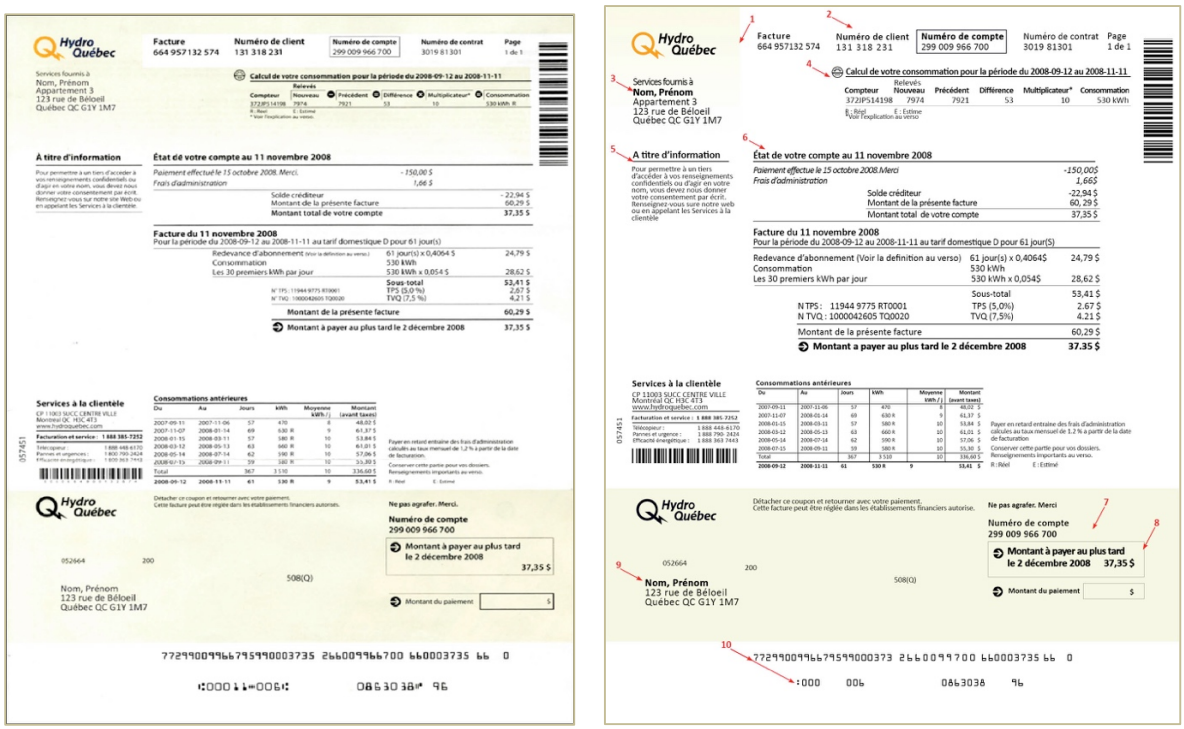


Figure 5.16: Hydro Quebec electric bill with the uniform connectedness principle applied

Lastly, figure 5.17 presents all the principles applied together. As shown in figure on the left, after applying the principles of proximity, similarity, good continuation and uniform connectedness (with minimal changes to the original layout), the Gestalt principles were shown to have an important positive impact on the document.

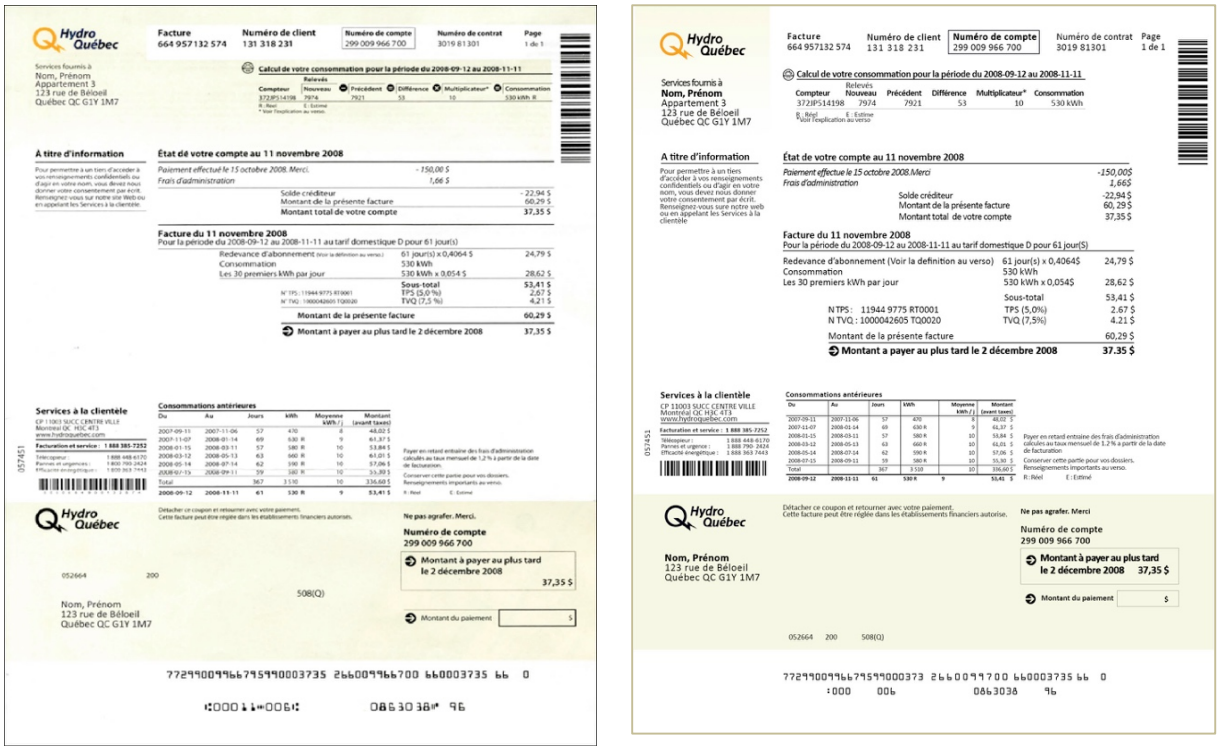


Figure 5.17: Hydro Quebec electric bill with all principles applied

5.7 Discussion

The overall purpose of this study was to comprehend the role of the Gestalt principles in the usability of public documents and further identify which of the Gestalt principles are or could be integrated in the design of public documents. In this manner, the study sought to examine a sample of public documents. The assumption of this study is that a better understanding of a user perception and cognition could provide useful insights on how to design their documents. Based on our experience conducting this research, we are able to provide the following insights:

1- In this study, we have proposed a comprehensive information design model that encompasses all the fundamental elements to first, assist organizations and sponsors in achieving their objectives, and second, empower readers to easily access the information they need and take the right decisions. Considering the proposed information design model in designing public document could contribute in document's quality and usability as it incorporates everything from the organization's goal, understanding user's needs and expectation, to presenting the final information product that suits user's perception using texts or graphics or both to achieve user's goal.

2- This study suggested some of the potential links between information design and the Gestalt principles of perception. In particular, we suggested that the Gestalt principles could provide a solid foundation for the design of public documents to address some of the challenges that might exist regarding how users understand public documents. We signify these links by identifying which of the Gestalt principles could be applied and how to apply them to enhance the quality of the public document.

3- This research provides further support for the findings of earlier studies conducted by Graham (2008) for enhancing visual communication within the context of interactive media design, as well as another study done by Yu (2014) for reducing complexity of genetics illustrations to raise public understanding towards genetics concepts. These studies showed the potential of Gestalt Principles in enhancing visual communications and genetics illustrations, respectively. In our findings, we were able to show the importance of applying the Gestalt principles in the design of document by providing an after version of the selected documents to help showcase each principle individually, as well as all the principles together to illustrate the differences between the original document and the document after the application of the principle which proves a useful evidence of our application.

4- With regard to the methodology of this study, the expert evaluation method provided a deep understanding of the document usability with the application of the three-level framework model: exploratory reading, comprehensive reading and interaction reading. Furthermore, providing an expert judgment from information designers could insure document quality, effectiveness and lead to measurable improvements in the relation between the document's sponsors and their target recipients. However, there is no doubt that applying a usability testing method along with the expert method to examine the documents could provide more insights and measure the user performance and understanding towards the documents.

5- In this study we chose two widespread documents in Québec, however, it is important to examine the Gestalt application on other public documents of different types; for example: print forms and/or online forms.

6- Additional point that is worth mentioning regarding the expert evaluation method is that analyzing each usability problem and trying to elucidate its relationship with either a design principle or a Gestalt principle was not an easy task.

7- The second method is the proposed document analytics method which used to measure the quality of the document in terms of the design principles application. This method was used to provide a precise data regarding the design of the document with the application of the Gestalt principles. However, while measuring the quality of information presented in the document could be of an assistance in examining the quality of the documents, this method might be challenging to be used by a designers given the length and the time it requires to develop the accurate data needed.

8- Regarding the results presented in document analytics method, it is worth mentioning that it is considered subjective. Despite the fact that, the scores presented to each block individually were given under the consideration of a specific criterion so that it provides the most accurate data however, the results for the selected documents could vary from a researcher to another.

9- Finally, a potentially important incidental finding of this study is that technical communicators do not demand a graphic artist skill in order to improve the visual presentation of a content. Rather understanding how users perceive and read documents as well as the application of the Gestalt principles of perception could improve the quality of the documents they create.

Insights from the redesign phase:

1- First of all, the re-design strategy that was applied in this study using the Gestalt principles of perception improved the visual structure of the documents. Accordingly, it could enable the reader to easily understand what to do and what to focus on. However, it is worth mentioning that while a minimal design approach was adopted just to demonstrate the effect of each principle on the existing design layout, a consideration of these principles in the early stages of the design process, would result in an even better structured design that could be better perceived by the reader.

2- When seeking a well designed document, we should have the attributes of the proper principles in mind, not only the aesthetic principles that makes a document look attractive but the principles that make the document well read and received by the user. However, applying the Gestalt principles of perception in this study for the purpose of functionality and usability of the document has also contributed in the document's appearance, as it reduced the complexity that was existing before such as: reducing the number of alignments and the graphical changes. This occurs when the redesign documents appear more simple with less alignments and balanced, blocks are more united and organized when they grouped together. Furthermore, uniting or reducing the graphical style in the document helps in creating more harmony and coherence to the document. To refine our point, figure 5.18 demonstrates grey blocks of information of the original election card just to show how the layout design was built, the red arrows indicates the overlapping of the blocks and the green arrows indicate the gap between the blocks. While figure 5.19 shows grey blocks of information of the redesign version after the Gestalt application. As anticipated, figure 5.18 is more structured and less complex than figure 5.19.

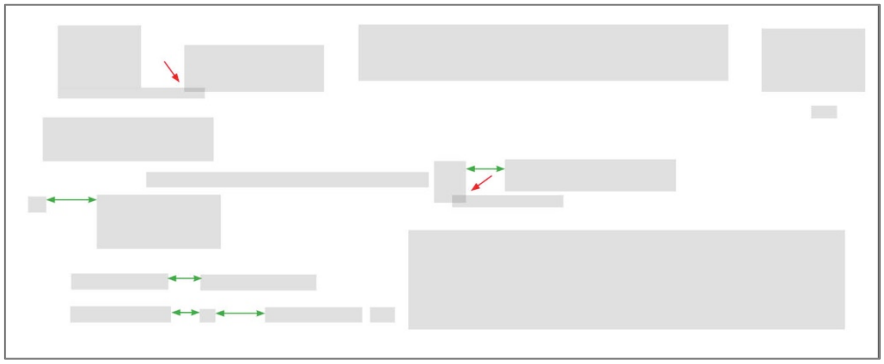


Figure 5.18: Grey blocks of the actual blocks of the original election card document with all principles applied

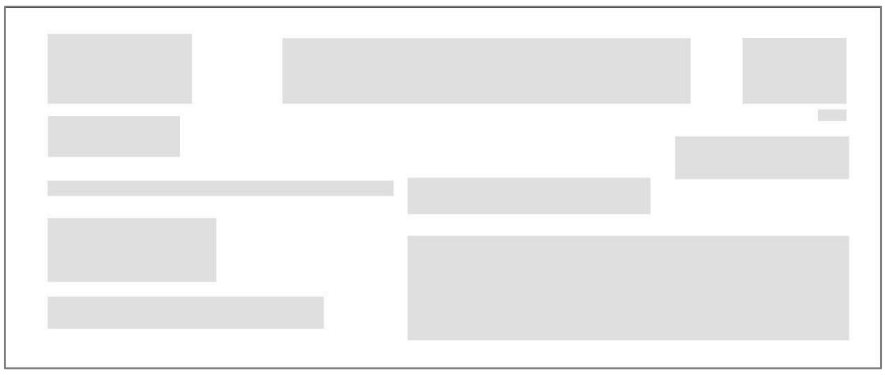
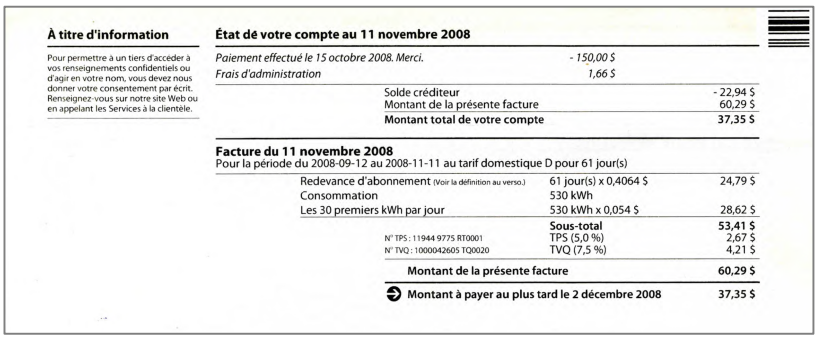


Figure 5.19: Grey blocks of the actual blocks of the original election card document

3- The possibility of solving the usability problems can not be based strategically on breaking down the Gestalt principles, as they should not be addressed independently. Meaning that, applying the Gestalt principles individually would not achieve the best result as shown in the redesign versions in chapter 5. Hence, a more reliable approach would be to look at the principles as a tool that foster the understanding of the document and assist in the accessibility of the information as shown in the final redesign version of both documents.

4- There are certain Gestalt principles that can not be applied on its own in the document. For example: applying the proximity alone in the document and grouping the related blocks of information together without having an actual based grid that supports the grouped elements could result in an unorganized document. Moreover, it will create an unclear reading path that will add more complexity in the design of the document. However, applying the proximity principle along with the good continuation would create better presentation of the design. As the good continuation assist in limiting the alignments and creates a structure-based layout that could be considered as a base layer for the designer to utilize.

5- To further elaborate the previous point, it is worth emphasizing that commencing with the principle of good continuation could be the key to build a well-designed document. Figure 5.20, shows a closer look on the calculation table of the original document of Hydro-Québec and figure 5.21 shows a closer look of the redesign version of Hydro-Québec document after the application of the good continuation principle.



À titre d'information

Pour permettre à un tiers d'accéder à vos renseignements confidentiels ou d'agir en votre nom, vous devez nous donner votre consentement par écrit. Renseignez-vous sur notre site Web ou en appelant les Services à la clientèle.

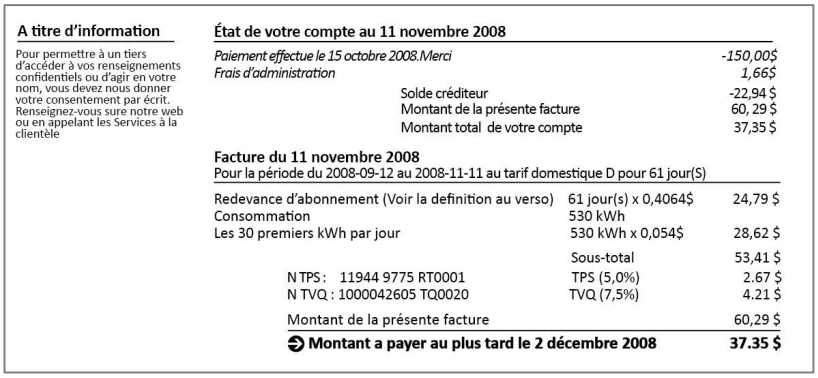
État de votre compte au 11 novembre 2008

Paiement effectué le 15 octobre 2008. Merci.		*- 150,00 $*
Frais d'administration		*1,66 $*
Solde créditeur		- 22,94 $
Montant de la présente facture		60,29 $
Montant total de votre compte		**37,35 $**

Facture du 11 novembre 2008
Pour la période du 2008-09-12 au 2008-11-11 au tarif domestique D pour 61 jour(s)

Redevance d'abonnement (Voir la définition au verso.)	61 jour(s) x 0,4064 $	24,79 $
Consommation	530 kWh	
Les 30 premiers kWh par jour	530 kWh x 0,054 $	28,62 $
	Sous-total	**53,41 $**
N° TPS : 11944 9775 RT0001	TPS (5,0 %)	2,67 $
N° TVQ : 1000042605 TQ0020	TVQ (7,5 %)	4,21 $
Montant de la présente facture		**60,29 $**
Montant à payer au plus tard le 2 décembre 2008		**37,35 $**

Figure 5.20: A closer look on the calculation table of the original document of Hydro-Québec



A titre d'information

Pour permettre à un tiers d'accéder à vos renseignements confidentiels ou d'agir en votre nom, vous devez nous donner votre consentement par écrit. Renseignez-vous sure notre web ou en appelant les Services à la clientèle

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N TVQ : 1000042605 TQ0020	TVQ (7,5%)	4.21 $
Montant de la présente facture		60,29 $
Montant a payer au plus tard le 2 décembre 2008		**37.35 $**

Figure 5.21: A closer look on the calculation table of the redesign document of Hydro-Québec after the applying the good continuation principle

By eliminating the unnecessary horizontal lines between the content, it keeps the reader on track without having to be distracted by more lines. Moreover, we sighted that the principle of good continuation along with the principle of proximity could have the biggest impact on the presentation of the document, for the following reasons:

- First, they provide the reader with a structured layout where the reader can easily identify the reading path as well as decreases the complexity of the document.
- Second, they emphasis the information that are related together and de-emphasis the information that are not related.
- Third, their application demands less effort from the reader to scan the document and go through it easily without having to read the document several time to understand what the document is about. For example: figure 5.22 demonstrates a public document letter of an insurance company, that although the documents lack certain design elements, the principles

of proximity and good continuation are applied which makes the document looks less complex and easy to identify.

Figure 5.22: An Insurance letter document

- An additional point is that both these principles contribute to a successful presence of the principle of closure which will help the reader to get engaged in the document and easily identify the document.

Next in the importance comes the principle of uniform connectedness as it guides the reader to grasp the highlighted information easily and in a less amount of time. Last but not least, comes the principle of similarity, when implemented individually on the selected document it shows a slight improvement in the display of the blocks of information. However, when it is combined with the rest of the principles it better assists in reducing complexity of the documents.

6- Another observation is that employing the Gestalt principles have sort of forced us to re-examine the irrelevant information or the information that are less important to the user and relocate them so the reader could be more focused on the important information, for example relocating the bar code in the election card from the left to the right so it does not interfere with the principle information as shown in figure 5.23.

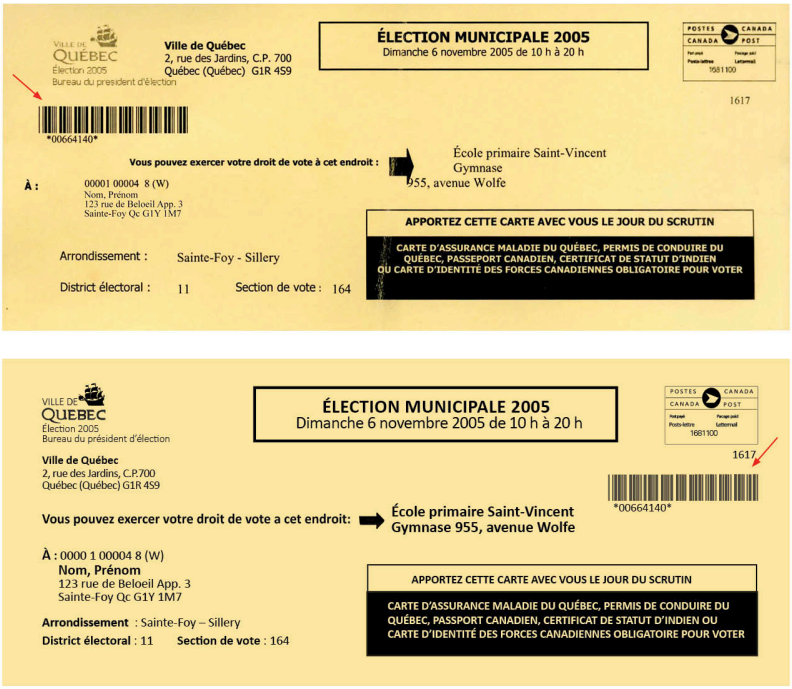

Figure 5.23: The before and after design of the election card document

Suggestions for future research:

1- We provided a descriptive explanation regarding the application of certain Gestalt principles on public document, however, it is also possible to construct more scenarios where other Gestalt principles could take part in the design process that might have a stronger impact on the design of public documents.

2- Additionally, each Gestalt principle could be examined and applied individually on various documents to test its impact on the documents. However, our assessments suggest that they will be more effective if applied all together.

3- To further elaborate the efficiency of the application of the Gestalt principles, future research could examine the application of the Gestalt principles on more public documents as well as on the online public documents such as: application forms, news websites, etc., to provide a stronger composition that facilitate communication between the reader and their documents.

4- We believe that understanding the role of Gestalt principles within the framework of document design could provide educators and students with a technical structure by which they can utilize to visually improve public documents.

In the final consideration of the study, we assert that graphics and visual layout of the document contribute to the success of the communication between the document and the user, yet without understanding how the user perceive and understand the document, it will lose its effectiveness. Hence, in designing public document, designers should apply the principles that integrate user's perception to create better designs for public documents.

Conclusion

Public documents are a very important medium of communication of information. However, they are generally known to be complex and difficult to understand and use. On the other hand, the field of information design is concerned with how to prepare clear and effective communication products that present complex information and data, by using both visual and verbal structuring, in an accessible and easy to use and understand format. Yet, there is a lack in applying the information design theories and frameworks to enhance the design practices of public documents.

Understanding how readers perceive and understand documents that they are presented is key for good information design of public documents. The Gestalt principles of perception examine how humans perceive and understand patterns. Moreover, the Gestalt principles of perception explain how the human mind handle (by grouping, completing, etc.) visual elements to form patterns when no real pattern exists. Accordingly, studying the application of the Gestalt principles in public documents can help in resolving and understanding many of the usability and design problems associated with this type of documents.

In this work, the application of the Gestalt principles to improve user understanding of public documents was studied. A methodology was proposed to enable the identification of the usability and design problems in public documents. This methodology comprises two methods; namely the heuristic evaluation method and the document analytics method. The heuristic evaluation method is an important tool in software design that is based on experts' evaluations. This method was adopted in this work to evaluate public documents and identify their usability problems. The document analytic method is based on taking precise measurements of the visual elements and components of the public documents in order to systematically identify their design flows and examine the application of the Gestalt principles in these documents. The proposed methodology was applied to a sample of two public documents to test its effectiveness. After identifying the usability and design problems in these public documents, using a minimal approach, the Gestalt principles were adopted and used to address and resolve the identified problems.

The findings of this study demonstrate the lack of applying essential principles in designing public documents, which could have an important impact on the user understanding and perception of public documents. Both expert judgement and document analytics revealed a variety of usability and design problems. The majority of these problems were due to the improper (or lack of) use of

certain design principles. Moreover, most of these problems were shown to be correlated to one or more of the Gestalt principles, which could resolve such problem if they were properly applied. This emphasizes the potential of applying Gestalt principles and integrating them in the design process of public document design to enhance both their visibility and usability in a way that improve the accessibility to the information that these documents hold and accordingly raise users understanding of these documents.

Appendix

Table A.1: The results of the document analytics for each block of the election card document

Blocks of information		Graphical style		Alignments		Reading Path			
Block's number	Block's name	A/N	Number of changes	Vertical	Horizontal	Horizontal alignment	Vertical alignment	Total H+V	The Reading path
1	A	A	2	1.00	0.33	1	3	4	1
2	B	A	1	1.00	1	2	7	9	3
3	C	A	1	1.00	0.33	1	9	10	4
4	D	A	3	1.00	0.33	1	12	13	5
5	E	N	0	1.00	1	4	2	6	2
6	F	N	0	1.00	1	3	13	16	8
7	G	N	0	1.00	1	7	6	13	5
8	H	N	0	1.00	1	6	11	17	9
9	I	N	0	1.00	1	5	12	17	9
10	J	N	0	1.00	0.5	8	1	9	3
11	K	N	0	1.00	0.5	8	5	13	5
12	L	A	1	1.00	1	9	10	19	10
13	M	A	2	0.50	1	10	4	14	6
14	N	A	2	0.50	0.5	11	4	15	7
15	O	A	2	1.00	0.5	11	8	19	10
			14	**14**	**11.00**				

Table A.2: The results of the Gestalt principles for each block of the election card document

Examining the Gestalt Principles of perception (scale from 1 to 5 where 1 is the lowest existence of the principle and 5 is the highest)							
Block's number	Block's name	Similarity	Proximity	Figure-Ground Relationship	Uniform connectedness	Good continuation	Closure
1	A	1	4	3	4	3	3
2	B	3	4	4	4	3	3
3	C	2	5	5	3	3	3
4	D	1	5	5	3	3	3
5	E	1	5	5	3	3	1
6	F	4	5	5	2	2	1
7	G	2	3	5	3	3	3
8	H	1	3	3	1	1	1
9	I	4	3	3	3	2	3
10	J	2	5	4	1	1	1
11	K	4	5	5	5	3	4
12	L	1	5	5	3	4	3
13	M	3	2	4	1	3	2
14	N	3	2	4	1	3	2
15	O	3	2	5	1	3	2
		2.33	**3.87**	**4.33**	**2.53**	**2.67**	**2.33**

Table A.3: The results of the document analytics for each block of the electric bill

Blocks of information		Graphical style		Alignments		Reading path			
Block's number	Block's name	A/N	Number of changes	Vertical	Horizontal	Horizontal alignment	Vertical alignment	Total H+V	The Reading path
1	A	A	1	0.2	0.2	1	2	3	1
2	B	N	0	0.2	0.2	1	5	6	2
3	C	N	0	0.5	0.2	1	8	9	4
4	D	A	1	1	0.2	1	10	11	6
5	E	A	1	1	0.2	1	13	14	8
6	F	A	1	1	0.2	1	14	15	9
7	G	N	0	1	1.0	2	15	17	10
8	H	A	1	0.2	1.0	4	2	6	2
9	I	A	3	0.5	1.0	3	8	11	6
10	J	A	1	0.2	0.5	5	2	7	3
11	K	A	2	0.2	0.5	5	5	10	5
12	L	A	4	0.2	1.0	6	5	11	6
13	M	A	4	0.2	1.0	8	2	10	5
14	N	A	2	0.2	1.0	7	5	12	7
15	O	N	0	1	1.0	9	1	10	5
16	P	A	1	0.2	0.5	10	2	12	7
17	Q	N	0	0.2	0.5	10	5	15	9
18	R	N	0	0.25	1.0	11	12	23	13
19	S	N	0	0.25	1.0	12	12	24	14
20	T	A	1	0.25	1.0	13	12	25	15
21	U	N	0	0.5	0.5	14	3	17	10
22	V	N	0	1	0.5	14	4	18	11
23	W	N	0	1	1.0	15	9	24	14
24	X	N	0	0.5	1.0	16	3	19	12
25	Y	A	1	0.25	1.0	17	12	29	16
26	Z	N	0	1	1.0	18	6	24	14
27	AA	N	0	1	0.5	19	7	26	15
28	AB	N	0	1	0.5	19	11	30	17
			24	**15**	**19**				

Table A.4: The results of the Gestalt principles for each block of the electric bill

Examining the Gestalt Principles of perception (scale from 1 to 5 where 1 is the lowest existence of the principle and 5 is the highest)							
Block's number	**Block's name**	**Similarity**	**Proximity**	**Figure-Ground Relationship**	**Uniform connectedness**	**Good continuation**	**Closure**
1	A	1	5	5	1	5	3
2	B	3	4	5	4	4	3
3	C	3	4	5	4	4	3
4	D	2	4	5	3	3	3
5	E	3	4	5	4	3	3
6	F	3	4	5	4	3	3
7	G	1	5	5	1	1	1
8	H	3	5	5	4	5	4
9	I	3	5	5	4	2	4
10	J	3	5	5	4	5	4
11	K	4	5	4	4	4	4
12	L	4	5	4	4	4	4
13	M	3	5	4	4	5	4
14	N	3	5	4	4	4	4
15	O	3	5	4	2	1	1
16	P	1	5	5	1	5	3
17	Q	2	4	5	2	4	3
18	R	3	4	5	3	3	3
19	S	4	4	5	4	4	3
20	T	3	5	5	4	3	3
21	U	3	4	3	2	2	1
22	V	3	4	3	2	1	1
23	W	3	4	3	2	1	1
24	X	4	5	5	3	4	3
25	Y	3	4	5	4	4	2
26	Z	1	4	4	4	4	3
27	AA	1	4	4	4	1	3
28	AB	1	4	4	4	1	3
		2.64	**4.46**	**4.5**	**3.21**	**3.21**	**2.86**

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