IS A PICTURE WORTH A THOUSAND WORDS?

EXPERIMENTAL RESEARCH ON THE USAGE OF INFORMATION GRAPHICS AS A PRESENTATION TOOL OF POLITICAL INFORMATION

By

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Abstract

Current research investigates the usage of information graphics within the context of politics. Information graphics as a data visualization tool has gained popularity among a variety of other fields, including marketing, education, etc. This popularity comes abound due to human's ability to perceive visual information even unconsciously and the brain's capacity to store visual images to long-term memory. The fact that infographics are combinations of visual and textual components gives a reason to hypothesize their efficiency as presentation and learning tools. Thus, this research aims to find answers to several questions. First, are information graphics more appealing presentation tools for politically related information than plain text? Specifically, can they help in enhancing interest in political information? Second, can political knowledge be enhanced by using information graphics as data visualization education tools? Third, can information graphics be implemented as presentation tools for candidates campaigning in order to make them more appealing to the voters? When investigating the last two questions, the importance of previous political knowledge was taken into consideration as a potentially important mediating factor. Using experimental methodology, this study seeks to assess the role of infographics as a potential method for enhancing political knowledge, increasing its appeal, as well as making candidates more attractive to voters.

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This is to her.

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Introduction

Normative democratic theory assumes that informed citizens make informed decisions in order to effectively participate in democratic procedures (Lau & Redlawsk, 2001) such as elections and referendums. Yet, in practice, individuals living in democratic societies are usually not even nearly as informed as they are expected to be[1]. We live in an era of constant technical development and a world in which information flows from all directions. Still, people tend to neglect the importance of political issues and seem demotivated to inform themselves. Instead of simply accepting this as a fact, it is worth asking what the reasons behind it are. Possible explanations are various. Still, one of them is that people find politically related information generally **unappealing**, **time-consuming** and **complicated**. The problem deepens even further when taking into consideration that people who are generally not interested in politics are not incentivized in any manner to get informed. The opportunity cost of enriching one's knowledge is relatively high (especially for those who are less knowledgeable), because it is highly time consuming and requires persistence. What would make one follow the political news instead of entertaining herself with a comedy show, for instance?

That being said, the following question rises: are **enhancing political knowledge** and **increasing interest** in politics **causa perduta** or is there potentially still a way to overcome this problem? This is one of the main questions that this thesis seeks to answers. In order to do that, an interesting phenomenon, which conquered the world of communication and raised many questions, should be introduced: *information graphics* or shortly, *infographics*.

According to Smiciklas (2012), infographs are a type of picture, which mixes data and design, thus helps individuals to communicate messages to their audience in a more consistent way and augments visual learning. More precisely, they are a type of visualization which presents

[1] About the ignorance of the general public about most of the political events (except for the most salient ones) talk authors like Converse (1975), Delli Carpini & Keeter (1996), Kinder & Sears (1985).

complex information in a simplistic way, helping people to quickly absorb and easily understand it. As a combination of images and graphics, infographics are claimed to be easier to understand.

As the purpose of infographics is a presentation of complex information in a simplified and appealing way, it is worth investigating their implication in the field of political communication. Presumably, this could significantly facilitate the digesting of politically related information, helping us simplify the relatively complex messages of political information and presenting it in a more appealing way.

More specifically, this research investigates infographics' application in a couple of political communication related fields. The first possible implication of information graphics is their adoption as a presentation tool for politically related information, more specifically, information campaigning. Graber (1988) acknowledges the fact that politics is usually considered to be complicated or even boring, and its lack of appeal is one of the reasons why individuals tend to reject it. He explains that when following the media, people who are generally more interested in politics are the only ones who pay attention to political stories. Therefore, we should be focusing on how to grab the attention of those who are not interested. The second implication is within the field of election campaigning. The hypothesis of interest is that presenting a candidate in an infographic would make her more appealing for the electorate. Following the theory of impression-driven candidate evaluation, which is presented further in this thesis study, one could hypothesize that in a world where voters do not have enough time to inform themselves about different candidates and lack the incentives to do so, it is possible that one could base her decisions on appeal.

The main assumptions of this thesis are that by implementing infographics in the field of political science as a form of information and candidate presentation tool, we could potentially increase political knowledge and interest in political information. The results found in this

study support the expectation that infographics enhance interest in political information, and are a more appealing way of presenting information than plain text. On the other hand, the expectation that they can help us enhance political knowledge was not confirmed (neither completely rejected), as results were not consistent. Yet, all these results are somewhat limited due to the small sample sizes and the potential sample biases.

Since the phenomenon of infographics is relatively new and unexplored, this is, to my knowledge, the first study in the political science field to look into their implementation. The goal is to not only investigate their potential role, but also to find empirical evidence for it, which is something that has also not been previously done. If the results of this study are confirmed through further research, they have the potential to being successfully implemented for the purposes of candidate and information campaigning.

Chapter I: The State of the Art

This chapter elaborates on what infographics are, what the main definitions in the field are and what, according to the visual specialists, constitute an efficient infographic. It also evaluates the current role of infographics and what contributed to the growth of their importance.

Infographics?

In order to explore the potential role of infographics in political applications, three main scientific areas have to be taken into consideration. First, the field of graphic design and data visualization design. The knowledge from this field helps me identify the main purposes of infographics and the benefits of data visualization over plain textual presentation. Second, the field of cognitive science, which is a scientific field in which the human mind and the ongoing processes in it are researched. The knowledge from this field helps me understand how the human brain perceives and obtains visual information. Third, the field of political science, in order to grasp how individuals learn politically related information, and how previous knowledge in the field affects gaining new information. In addition, theories about how individuals evaluate candidates and how political sophistication affects candidate evaluation are also implemented in this study. They are necessary components for the testing of the last hypothesis, presented in the *Introduction.*

The structure of this section develops from the following logic. The first issue discusses what infographics are and how they come to be. Since this study is dealing with visual presentation of information, the second topic discusses theories of visual perception. The last issue, on which I extensively elaborate, and a basis for the understanding of political knowledge, is motivation learning theories and how people learn political information.

Since prehistoric times, human beings use pictures to express themselves and communicate between each other. It is a common belief that people like to see information visualized.

Although much has changed since then, some people argue that pictures still rule. This claim is supported by the current growing importance of infographics in the field of marketing, advertising and communication. This section clarifies what infographics are and what caused the growth of their usage.

1.1. Main definitions

It is challenging to find a specific definition for the term "information graphic" as it is relatively new and unexplored. As it was previously clarified in the introduction, infographics are a kind of information visualization, which combines data and text. According to Brasseur (2003) infographic is a wide term, which includes visualization tools such as charts and graphics. For Rendgen (2012) what is specific for infographics is the combination of short text with visual elements, including images and charts. Jones (2015) argues that what distinguishes infographics from other types of visualization tools is that they "are to be read on a single surface" (p. 291). A slightly different explanation about the nature of infographics is given by Cairo (2013); the author accounts for their presentation, as well as exploration component, which form an infographic. He specifies that infographics (and visualizations in general) do not only present information, but also ease readers in comprehending the analysis of what is shown to a certain degree. The accent in the infographics, according to Cairo, is on the presentation component, leaving the reader with very little space for her own interpretation.

As the research and literature on the topic are scarce, the given definitions are relatively vague. According to them, different types and styles of data visualization can be classified as infographics. Following the discussed specifications, in this study the following definition of an infographic will be used:

An information graphic is a type of graphical visualization, which combines short text with visual elements (such as charts, graphics, and images). It is to be read on a single surface (like a poster and unlike presentation slides) and the information flows horizontally or vertically. It

favors the analysis of complex information by emphasizing on the presentation rather than on the exploration element.

1.2. What is an efficient infographic?

It is hard to give a straightforward answer to this question. As it will become clear from the results of this study, not every type of infographic is efficient and appealing to the audience. Even data specialists and designers still argue about what makes a data visualization tool good and thus, efficient. The debate over what exactly constitutes an infographic and what it includes is still ongoing. Two contradictory visions exist of what an efficient infographic should contain. The first supported by the statistician Edward Tufte (1990, 2001), is that the design of data visualization is very tricky and should be carefully approached. For him, the good visualization puts emphasis on the data and the content of the presented information rather than on beauty and art. Successful data visualization (and in that sense an infographic) contains words, numbers and drawings. Tufte (1990, 2001) is very particular about unnecessary graphic elements, which do not communicate any specific information. He argues against their usage, claiming that decorative elements can only distract the viewer and reduce the visualization value. He classifies this kind of data visualization as "junk chart". The second point of view is supported by graphic designer Nigel Holmes. Holmes (1984) argues in favor of strong decoration when making information designs. For him, heavy illustrations used in data visualization do not diminish its quality. On the contrary, he claims, it makes the presentation even more appealing and attractive to individuals.

Lankow et al. (2012) summarize that there are two approaches to infographics design: explorative and narrative. The first one is minimalistic, including only data visualization elements in the plainest and briefest way and it mainly seeks to communicate information. The second one is illustrative, with a main accent on the design. The main aim is to appeal to the viewers with embellished visual elements and to entertain as well as to inform the public. Both

approaches are experimentally tested by Bateman et al. (2010). The results from this study show that both methods work equally well on the short term, but the more decorative approach helps individuals remembering better on the long run.

However, three main criteria should be taken into consideration when creating an effective piece of visual communication. First is the appeal – it should engage public voluntarily. Second is the comprehension – this piece of communication should provide knowledge and should ensure unambiguous grasp of the provided information. And third is the retention, meaning that it should contribute to creation of long lasting knowledge. (Lankow et al., 2012)

To conclude, it is crucial when communicating visual information to not simply use visual elements as an additional ingredient to the written discourse. This could result in a gap of meaning between the visual elements and the textual information that they accompany. Furthermore, it devaluates the potential power of the visual language (Trumbo, 1999).

1.3. The growing importance of infographics

The rise of the infographics is usually related to the development of computer technologies and to the significant role of Internet nowadays. However, the prototype of the modern infographics was invented right after the First World War by the Austrian philosopher Otto Neurath in collaboration with a team of data specialists and artists. It was called Isotype (International System of Typographic Picture Education) and its purpose was to visually present complex data and make it comprehensive for a wider audience (Mol, 2011). The development of computers and programming languages provided additional opportunities for creating interactive data visualizations on computers (Brunelli, 2010). Cairo (2013) argues that an additional drive to the rise of infographics is given by readers' appetite for small packages of information accompanied by good visual elements. This makes infographics a more preferable tool for information presenting than long, in-depth texts.

Indeed, the growing importance of the Internet and social media has played an important role in the expanding usage of infographics. Nowadays they are widely posted and used mainly, but not limited to, social media and blogging websites like Twitter, Facebook, Flickr, etc. According to data published on Google Trends[2], the search of the terms "infographic" and "infographics" has been growing significantly since the year 2010. Well-established media sources like The New York Times also has its own learning website[3], called The Learning Network, where information is presented in infographics. The rise of infographics does not come as a surprise. Their popularity could be well explained by their high level of appeal, as suggested by a 2007 study conducted by the Poynter Institute. In the study, which uses eye-tracking technology, Edmonds et al. (2007) identify what kind of information presentation appears to draw the most attention. This method also allows for getting insights on what a reader finds interesting and what captures an observer's attention (Duchowski, 2007). Using this technique, Edmonds et al. (2007) analyzed what readers paid attention to while reading the pages of a newspaper. The results from this study showed that infographics are as appealing as photos. In addition to that, results show that the text, presented in an infographic, was read by 87% of the participants who saw it, whereas only 41% read a normal article text. These result are evidence for infographics' appeal function.

[2] https://www.google.com/trends/explore#q=Infographic&cmpt=q&tz=Etc%2FGMT-2
[3] http://learning.blogs.nytimes.com/tag/infographics/?_r=0

Chapter II: Theory Building

In this chapter are discussed several theories of perception, adopted from psychology and cognate science. It contributes to the understanding of how individuals perceive visual and retain new information, more specifically, what the role of previous knowledge in information processing is. This faciliates the comprehension of how people will perceive and learn from political information, presented in infographics.

1.1. Theories of Perception in Cognitive Psychology and Cognitive Science

So far it has become clear what infographics are and how they conquered the world of communication as **an appealing** and **potentially efficient educational tool**. Yet, this does not explain what exactly makes them efficient (*how* do people learn from them and *why*). In order to explain this, I use knowledge from psychology and cognitive science. More specifically, the part of them which explains the processes which take place in the human brain when visual information is being perceived. In this section, a few theories of perception are presented and used as basis to explore the potential role of infographics in political science.

1.1.1. Gestalt theory of perception

According to the Gestalt theory of perception introduced by the Berlin school of Gestalt psychology (Wertheimer, 1923; Köhler, 1929; Koffka, 1935, Metzger, 2006), human beings perceive the world as a series of complex scenes constituted of different groups of objects on a certain background. These objects, on the other hand, are composed of parts (which might be built up on other parts).

At the core of Gestalt psychology is Wertheimer's (1923) claim that perception of movement is a phenomenon with its own ontological status. Thus, he concluded that mental life is

constructed by structured wholes (Gestalten). These structured wholes, according to Gestalt theory, forego their constituent parts and properties. Individuals initially register the objects on the visual field, as well as the on-going relationships between them and only secondary if necessary analyze them and their composing parts and properties. As much as the perception of structured wholes is a complicated process, human beings **do not have conscious access or control** and do not put any specific effort in order to achieve it; it is a **completely automatic process**.

The principles of Gestalt theory of perception still have its followers. Scientists such as Fred Attneave, Wendell Garner, Julian Hochberg, etc. incorporated the principles of Gestalt theory in their information processing models. It also has its critics. The feature-integration theory of attention, which was developed sixty years later and argues against the forming principles and presumptions of Gestalt theory, is discussed in the next section.

1.1.2. Feature-Integration Theory of Attention

Treisman and Gelade (1980) and Treisman (1986) critically assess Gestalt's theory of perception. Thus, they introduce a new theory, which they call Feature-integration theory of attention. Treisman and Gelade (1980) argue that "features are registered early, automatically, and in parallel across the visual field, while objects are identified separately and only at a later stage, which requires focused attention" (p.98). One of the main assumptions of their theory is that a visual field is initially perceived in separable dimensions. These dimensions are colors, brightness, orientation, etc. On the other hand, these dimensions have their own values, called features. For instance, color is a dimension according to their theory, but yellow is a feature to this color.

Most importantly, according to this theory, what binds dimensions together with their features is *focused attention*. Attention is a necessary condition for correct perceptions of the dimensions and their features. Both authors explain further that even unattended areas are not

perceived as empty spaces. When unattended areas are perceived, their processing is possible due to the utilizing of past experiences and contextual information. Therefore, as they point out, even if one's attention is not pointed to the skies, it is unlikely to perceive a blue sun and yellow sky. All in all, feature-integration theory presents a two-staged model of visual perception. The first stage is *pre-attentive*, in which an object is only perceived via its elementary dimensions. This process is automatic, happens without putting any effort into it. The second stage is *focused attention*, in which the specific features are assigned to their dimensions[4].

1.1.3. What do theories of visual perception tell us?

The most important thing that could be extracted from the presented visual perception theories is that individuals perceive visual information **automatically** (according to the Gestalt theory) or even **without paying focused attention** to a certain object (according to the feature-integration theory). Evidence for the second one comes from Treisman (1977), Treisman & Schmidt (1982) and Goldstein (2010). By presenting participants with rapidly changing visual stimuli and asking them to focus their attention to another main object, participants were able to report some of quickly changing stimuli although their focus was not on the stimuli. Unconsciously, the human brain perceives visual information constantly and naturally.

Not only this, we fully trust what we see. Take as an example the famous Müller-Lyer illusion (Figure 1). What we all see are two differently-sized lines. Nonetheless, we are all wrong. Their lengths are absolutely equal. However, one has to measure their lengths for reassurance while it is just easier to trust our eyes.

[4] There are of course other theories and approaches of visual perception, for instance ecological (Gibson, 1971) or computational (Marr, 1982), but models with two or more stages of perception are gaining most commonly accepted by psychologists, cognitive scientists and computer scientist working on the topic.

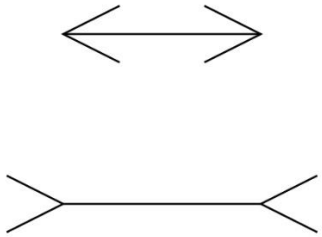


Figure 1: Muller-Lyer Illusion

These theories are important for the current study because they explain how humans perceive visual information. The fact that we constantly perceive the surrounding world visually explains **what makes infographics highly appealing**. The section below, on the other hand, gives a theoretical explanation of what makes infographics an efficient learning tool.

1.1.4. Why is visual information so powerful?

When one perceives a certain message visually, it first goes to her short-term memory and only after that to the long-term memory. Kosslyn et al. (1996, 1999) explain that a significant part of human experiences and memories are stored as images in the visual cortex. In other words, we learn everyday by simply seeing, because what we see is stored in our long-term memory and we constantly see even without our attention being focused on a certain object. Ware (2012) explicates:

The human visual system is a pattern seeker of enormous power and subtlety. The eye and the visual cortex of the brain form a massive parallel processor that provides the highest-bandwidth channel into human cognitive centers. At higher levels of processing, perception and cognition are closely interrelated, which is why the words understanding and seeing are synonymous. (p.12)

In this section, I explained what makes infographics appealing. The next section shortly summarizes **what makes them an efficient learning tool**.

1.2. Motivations to learn and information processing theories

After clarifying how people perceive visual information, here it is discussed how they select the information to which they pay attention to. This is important, because it can give an overview of how individuals select political information. Also, once having selected the information, how they process and respectively learn it. How people perceive visual information is just one side of the coin. How they extract information from it – is the other. Both together can explain what affects how much and why people retain when facing new information.

1.2.1. To learn or not to learn? – Learning motivation theories

Three main theories of how people select and reject information, presented by Graber (1988) are discussed. The first one is the Uses and Gratifications Theory. The second one is the Cognitive Balance Theory. And the third one is the Agenda-Setting Theory. This section helps us assess what kind of political information people do and do not pay attention to. This can help identify the reasons for information rejection.

Atkin (1973), Blumler (1985), Becker & McLeod (1981) explain that the essence of the Uses and Gratification Theory is that people would only pay attention to information, which they find useful in their daily lives, or which brings them psychological gratification. According to the Cognitive Balance Theory, on the other hand, people would only pay attention to information which confirms their previous knowledge, attitudes, beliefs and feeling. Last, as per the Agenda-setting theory, people are guided by media of their own choice when selecting information to which they pay attention to. Individuals select information based on cues provided by media coverage, such as the frequency of topic coverage and the notable display of important stories (Graber, 1988).

1.2.2. Nothing else matters? – The importance of the contextual factors

Of course, it is very limited to think that any of these theories can fully explain why people would be incentivized or not to read or learn any kind of politically related information. As Graber (1988) points out contextual factors also matter when one is investigating what makes people pay attention or avoid political information. Some of the factors he lists are political socialization and impact of lifestyle, life experiences, previous political knowledge and current needs for certain types of information.

Among all these factors, the one variable that deserves special attention is *political knowledge*. It is impossible to investigate political learning (or any kind of information retaining, for that matter) without taking into consideration this variable. Research on the topic has shown that possessing previous information on a certain topic influences how one operates with new information on the topic (Graber, 1978; Hamill & Lodge, 1986, Lau & Erber, 1985). Empirical data from previous studies reveal a phenomenon called the "knowledge-gap". According to the knowledge-gap hypothesis, people who are already knowledgeable on a topic, become even more knowledgeable after receiving additional information on it; whereas those who do not have as much prior knowledge remain on the same level even after exposure to new information (Donohue et al., 1970; Moore, 1987). This can be explained with the fact that previous knowledge accommodates schema that mitigates absorbing of new information. I explained how this happens below.

1.2.3. Information processing models

1.2.3.1. Schema theory

Information processing starts when physical signals reach the sensory organs (this process was briefly explained in the previous section). After the information is perceived, the new one is simplified and compressed and sent for a rapid storage in the short-memory. Next, it is sent to the pool of information, where it is checked if it could be successfully adopted to any of the

existing memory schemata. In case the information is successfully absorbed, it becomes a permanent part of one's existing schemata structures (Benett, 1979; Norman & Bobrow, 1976; Lachman et al., 1979).

What is "schema"? Many definitions of this phenomenon have been given by different scholars, but most of them agree that schema is a cognitive structure, which consists of information units and linkages between them (Bartlett, 1932; Fiske & Linville, 1980; Fiske & Dyer, 1985). Hayes-Roth (1977) describes that schema (or also "knowledge structure") is built of components (or also "cogits") and links (or also "associations"), binding the components. When one of the schemata components is activated, it automatically activates some of the links to its components, depending on the strength of the connection between them. With an individual's growing experience, schemata progresses as well. At the starting point of its progress, it only collects individual components; by the final point, it is already a single unit, well integrated and structured and with very strong connections between the components. Axelrod (1973) simply explains that schemata are used when "a person tries to fit the new information into the pattern which he has used in the past to interpret information about the same situation" (p. 1248). Following Heider's balance theory (1958) and Hayes-Roth's theory (1977), Axelrod (1973) and Sentis and Bernstein (1979) argue that an often used social schema – *balance* schema, is formed as a single unit in one's memory. For instance, "[a] person has a balanced set of beliefs about his acquaintances if he believes that all of his friends like each other, all of his enemies also like each other, and each of his friends dislikes and is dislikes by each of his enemies" (p.1248). In case a person fits her relationships with friends and acquaintances into a balanced schema, when new information about a specific relationship is perceived, she tries to fit it into the already existing schema (Axelrod, 1973) [5].

[5] Thus, one possible interpretation of this theory is that previous knowledge biases us. It works on the principle of prejudice – we get new information an on basis and interpret it according to the previous knowledge we have about it.

Lodge and Hamill (1986) summarize the main purposes of schemas that have been identified:

1. Provide categories for labeling people, places, events and processes;

2. Facilitate the chunking or grouping of information into larger, more meaningful, and easier retrievable categories;

3. Influence what information will be attended to, encoded, and retrieved from memory;

4. Facilitate recognition, recall, and ease of retrieval of schema-relevant information;

5. Enable the individual to make inferences from incomplete data by filling in missing information with schema-consistent best guesses;

6. Provide basis for making more confident decisions and predictions; and

7. Influence the weighting of evidence brought to bear in making decisions and evaluating probabilities. (p. 506)

In cognitive psychology literature, individuals with well-developed knowledge structures (schemas) are classified as *schematics* (referred as sophisticates in this study), whereas the ones without well-grounded and elaborated schemas are categorized as *aschematics* (referred as novices). The reasons why one does not possess well-developed schemas might vary from lack of interest, lack of ability for development to lack of experience (Markus, 1977). The way in which both types (schematics and aschematics) perceive new information differs significantly. Previous knowledge plays an important role when perceiving and interpreting new information (Conover & Feldman, 1984; Lodge & Hamill, 1983). Sophistication, from a cognitive point of view, is principally indicated by one's issue-specific interest, previous experience and knowledge (Lodge & Hamill, 1986). Thus, the application of schema theory to this study dealing with political information processing, is not a simple, but a crucial task. Political learning cannot be evaluated by simply neglecting the importance of previous knowledge.

1.2.3.2. Heuristics and biases theory

On the other hand, a theory, introduced for the first time in 1974 by Amos Tvesky and Daniel Kahneman, known as *heuristics and biases theory*, challenges the view of information-processing from a slightly different angle. This theory, widely accepted in the field of political science, argues that the human brain is operated and controlled by two parallel systems – System 1 and System 2. Like the two-stage model of perceiving visual information, in which the first stage is pre-attentive and the second one is attentive, Kahneman and Tversky, argue that what differentiates System 1 from System 2, is attention. System 1 works instantly and automatically. Its judgements are made unconsciously, with putting little or no effort into their making. On the contrary, the judgments of System 2 are intentional and well-considered. The main job of System 2 is to locate the attention to the mental activities that require it. These conscious mental processes are slow and effortful.[6] Kahneman (2011) gives examples of activities, which are overtaken by the two systems. The first one covers actions such as detecting if one object is closer than another, identifying the source of a sudden sound, calculating 2 + 2, recognizing that the capital of France is Paris. The second one, on the other hand, is associated with actions such as searching memory to identify an unexpected sound, counting how many times a certain letter appeared in a full-page text, verifying the soundness of a complex logical argument, etc.

System 1 and System 2 are in a constant rivalry over dominance. Since it takes great effort and mental resource to engage System 2 into every single action, System 1 has taken over a big part of the tasks that one has to cover on regular basis. Within this model, heuristic reasoning (intuitive) can be observed when System 2 reaffirms the judgments made by System 1. Biases occur when System 2 fails to correct the information wrongly applied by System 1 heuristics

[6] Just like in the two parallel lines in the figure showed previously, Kahneman (2011) argues that the judgement of System 2 is activated only when we put effort into measuring the length of the lines.

(Kahneman & Frederick, 2002). Therefore, individuals' judgments can be incorrect and biased, providing misleading solutions (Tvesky & Kahneman, 1974).

We live in a dynamic world in which decisions have to be made in a limited amount of time. Kahneman (2011), therefore, claims that System 1 has overtaken most of our decision-making processes. Since very often we are biased by the judgments of our System 1 and the previous knowledge that we have, it is crucial to find a method of presenting information which does not require too much effort to be absorbed.

1.3. Conclusion

In this section some of the factors explaining how and why people select political information are briefly summarized. It is also explained how individuals retain political information, emphasizing on the importance of previous knowledge. The presented theories help us build some theoretical expectations of how people will retain information presented in infographics, which elements of the structure of infographics account for their appeal and what is the potential impact of previous knowledge on retention of new information.

In order to put the pieces of the puzzle together the following questions should be evaluated:

- Do infographics help people retain more politically related information than other presentation forms (plain text)?
- Do infographics send more appealing political messages than other presentation forms (plain text)?
- Does previous political knowledge bias us or help us retain more information?

In order to find an answer to these questions, multiple experimental studies were carried out. Their designs and results are discussed in the next chapter.

Chapter III: Methodology and analysis

In the current chapter the methodological tools used in this research, the research design and the results from the conducted studies will be discussed and evaluated. The chapter begins with justification of the method and proceeds with each experimental study performed for the purposes of the thesis.

In order to investigate the potential role of infographics in the political science field, multiple experiments were carried out. McDermott (2002) points out three main circumstances in which an experimental design is recommended:

> "when existing methods of inquiry have produced inconsistent or contradictory results; when empirical validation of formal models is required; when investigators want to triangulate in on specific processes that have already been examined in a more general way using other methodologies; and when evidence is needed to support strong causal claims" (p. 32).

The fact that this field has not been empirically approached previously and there is a need of establishing a causal relationship, make the experimental design an appropriate choice.

A series of experiments were conducted in the period of late April – late May. The first one, a pilot study, took place in April, 2016. The second one, a student sample lab experiment, was conducted in late May, 2016. The third was run shortly before the forth one, both in the end of May, 2016. They are presented and discussed in the above-mentioned order.

1.1. Design of the pilot study

The first phase of this study was carried out in late April 2016, and it was aimed at testing the efficiency of infographics as a learning tool and their appeal.. A total of 136 participants were randomly assigned to two different treatment conditions. The experiment contained three

stages – the first stage was exposure to the treatment; the second phase was a short knowledge test; the third phase was a short questionnaire concerning the level of interest generated and the level of appeal of the information.

1.1.1. The platform

The experiment was carried out on Amazon Mechanical Turk, an online platform that enables researchers to post Human Intelligence Tasks (HITs) to individuals who complete different tasks as a paid service. Due to the relative affordability of the sample, mTurk is considered the most appropriate data collection option. Berinsky et al. (2012) investigate the advantages and drawbacks of the platform. In general, mTurk's samples are more affordable to recruit than other nonstudent adult samples and relatively more representative than other convenient samples used in social sciences. On the other hand, mTurk participants are considerably younger and more liberal than the general American population. In addition, they are more attentive when taking a certain task than other respondents. The last one raises the chances of external validity problems. (Berinsky et al., 2012). This, combined with the self-selection problem (only mTurk users who are interested with the study participate), might result in biasing of the sample and challenging the validity of inferences made with mTurk samples.

1.1.2. Sample characteristics and demographics

A sample of 136 participants, among who 56.6% were males and the rest – females. When it comes to age, 59% of the participants were between 26-40 years old, 20.3% were between 18 and 25. Caucasians were overrepresented in the sample, composing 85%, whereas blacks and Latinos/Hispanic were underrepresented (only 0.7% and 8.4%, respectively).

As discussed in the previous section, although the participants in the mTurk pool are not less representative than other convenient samples used in political science, in general, they are younger, more liberal and more educated than the average American. This should not be neglected when drawing the conclusions and inferences of this experimental study.

1.1.3. Treatments

Americans build their political knowledge primarily on media and news (Graber, 1993; 1996). Thus, the main types of information presentation that they are exposed to are textual (newspaper and magazine articles) and visual (television news). Because of the nature of television – combination of visual and audio elements, it was not possible to compare infographics with news emission. Thus, a decision was made to compare information graphics with plain textual information. Participants were randomly assigned to two treatment conditions. The first among the two groups (N=65) received a visual treatment (information presented in an information graphic). The second (N=71) received textual treatment (the same information in plain text).

The information in the treatments covers a climate change issue, explaining what causes climate change, and provides a couple of possible solutions to the problem. The aim of the text is to raise awareness of the problem and to point out the necessity of governmental regulations. The infographic was designed for the purposes of the experiment and introduced the same information as the plain text treatment, while also providing visual stimuli and visual data insights. Green theme color was used for its design, because it is usually associated with environmental issues. Red color was used for the elements explaining what causes the problem, because it raises one's attention[7].

Both groups were given the same *minimum* amount of time to get familiar with the text, which length was approximately 330 words. According to Trauzettel-Klosinski & Dietz (2012), the average reading speed in English is 228 words/min. Taking into account the fact that mTurk participants are well trained at quickly and efficiently accomplishing tasks, both groups were required to remain on the treatment page for *at least one minute*.

[7] Both infographic and text can be found in the Appendix section.

The between-person design was adopted, because it allows for independent analysis of the effect of the treatments on both groups. This design aimed at showing if (a) individuals perceive and retain information better if it is presented in a visually appealing way (infographic); (b) a more appealing presentation raises awareness more efficiently and (c) individuals assess infographics as more appealing method for presenting information.

1.1.4. Post-treatment Stage

After the treatment, participants were asked to fill in a short knowledge test asking questions about the information to which they were just presented. The questions covered different aspects of the presented information, starting from particular percentages and numbers to more general and intuitive questions about problem solving. Due to the limited length of the text, participants were only asked to answer six questions. Afterwards, the result that they received on the knowledge test was a simple sum of the correct answers.

In the final phase of the experiment, participants were asked to answer five additional questions concerning the level of interest that the information provoked; the level of awareness that was raised; as well as the level of appeal of the information. These variables were measured on seven-point scales (from extremely interesting/important to completely boring/unimportant). The reason for choosing an odd-numbered scale was based on the expectation that the responses would be somehow skewed to either positive spectrum or negative spectrum.[8]

After answering all questions, the respondents were asked to fill in a demographics questionnaire asking about their age, race, income, political views, etc. At the very end of the study, they were presented with a disclaimer, in which the real purpose of the experiment was explained, informing them that the collected data will only be used for academic purposes.

[8] All questions posed to the participants in the post-treatment stage can be found in the Appendix section.

1.1.5. Results

1.1.5.1. Variables

- *Retained knowledge* – measured on a 6-point scale
- *Level of awareness* – measured on a 7-point scale
- *Level of appeal* of the presented information – measured on a 7-point scale

1.1.5.2. Analysis

The roughly equal sample sizes allowed me to use Welch's Two Sample t-test to test the hypothesis of null hypothesis of equal population means, although the relatively small sample sizes might undermine the power of the analysis. In order to proceed with the analysis, the data skewness and kurtosis were first examined, as well as histograms of individual variables, which showed that they were close to normal distributions.

Before the data analysis, the results of the knowledge test were merged into a knowledge variable, measured on a scale from zero to six. After running the Welch's Two Sample t-test with knowledge variable, the results showed that there was no significant difference in the means of the two populations. With a p-value of 0.3, the data does not provide evidence to reject the null hypothesis.

Nonetheless, This test provided me with an interesting insight of the data. The mean of the group who received the textual treatment was higher than the one who received the infographic (means were 4.1 and 3.9, respectively). That signalized that people who received textual treatment scored higher on the knowledge test and learned more, respectively. Subsequently, the Cronbach's Alpha test was used for reliability of the measurement scale analysis. The alpha of 0.44 showed that the measure of knowledge was not consistent. Thus, one has reasons to doubt the meaning and importance of these results.

The next two response variables in the analysis were designed to measure the level of awareness that was raised by the treatment. Again, using the Welch t-test, the null hypothesis

of equal population means was tested. It became evident from the analysis that people who received the **textual** treatment assessed the climate change as more important than those who received the infographic. In general terms, the means with values around the two show that both groups assessed the problem as important.

Table 1: Results t-test

Variable	Mean in group Infographic	Mean in group Text	df	p-value
Level of awareness (question 1)	2.04	2.53	127.73	0.05*
Level of awareness (question 2)	2.01	2.57	127.77	0.02*

Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

In addition, reliability analysis was used for these two questions. With Alpha of 0.93, one can conclude that the measure of level of importance is consistent and the scale is reliable.

The last variable of interest measures the *level of appeal* of the information visualization. Again, the Welch Two Sample t-test was used to compare the means of the two populations. With a very high p-value of 0.8 and means of 3.29 (for the group presented with an infographic) and 3.23 (for the group presented with plain text), one cannot reject the null hypothesis, meaning that the information presented in the infographic and in the plain text, were equally appealing.

1.1.6. Discussion and conclusions

The results from the experiment appear to be counter intuitive and thus, puzzling. According to the current state of literature, information graphics are highly appealing because of their visual element. In addition, research on memory processing in the human brain argues that visual elements stimulate memory capacity. In light of this, it was expected that the participants in the group that received the visual treatment were to score higher than the one that received

the textual one. In fact, participants who received the textual treatment scored higher on almost all questions, although the difference was not of statistical significance. The puzzle becomes even more interesting when considering the fact that participants who were exposed to the visual treatment had visual cues on questions two and four.

In light of the fact that people who received the information in plain text learned more, it is not entirely surprising that they assessed the climate change issue as more important than the ones who received the visual treatment. In that context, the results of the dependent variable measuring appeal are also not entirely surprising. That fact that the participants did not characterize infographics significantly more appealing than text is somehow related to the fact that they did not learn a lot by it.

The importance of these results should not be neglected. Neither should one simply disregard the power of information graphics. Instead, one should carefully investigate and evaluate the meaning of these results. The reasons behind these results might be hidden somewhere in the nature of the infographic that was presented. A couple of issues might have arisen from it. First, the information in the infographic does not follow any specific logic. If participants did not see a clear structure to it, it might have prevented them from investigating it in detail. As a matter of fact, one of the two questions in which participants in the infographic performed slightly better than the participants in the second group, is the fifth. This could be explained with the fact that the information, which discussed the fifth question, was in an independent block, far from the rest of the information. Whereas the first part of the infographic is unstructured and contains too much information concentrated on relatively small space. Second, the high amount of visual elements might have been in fact distracting for the participants, making them neglect the importance of the textual information. Furthermore, the infographic was not designed using any special design software, which might have reduced its quality.

Taking this into account, maybe communication experts, who claim that heavy decorations and emphasis on art instead of data can be distracting and leads people not to pay serious attention to the information, are right. Therefore, it is of high importance that this puzzle is further investigated. It is worth testing the efficiency of very simplistic, highly structured and straight to the point information graphics in comparison to unstructured ones, emphasizing on beauty rather than on information.

In additional, one alternative hypothesis is worth considering. As it has been previously discussed, mTurk participants pay more attention to the tasks. They are well trained in quickly reading and absorbing information presented in plain text. On the other hand, information graphics are something new and unfamiliar to them. It could be hypothesized that while experienced in dealing with textual formats, the new format of the infographic took them by surprise. Presumably this was the reason why these, who were asked to read the short plain text, performed better.

1.2. Design of the lab experiment

To test if mTurk participants training in reading and information obtaining led to the results of the pilot experiment, a lab experiment was designed. A non-random student sample of 35 graduate students from Central European University, Budapest was recruited and randomly, by fair coin flip, assigned into two treatment conditions. Similar to the usage of mTurk sample, student samples come with certain tradeoffs. First, student samples enhance external validity. Druckman & Kam (2011) emphasize that generalizability of the results of studies carried only with student samples can be doubted when the sample characteristics affect strongly the moderator and mediator variables. They, further, explain that external validity is not only enhanced by the sample characteristics, but on other factors (such as time, context and conceptual operationalization), as well.

Unfortunately, it is possible that the level of education or education status could appear to be either a moderator or mediator variable. Graduate students are trained in reading and skimming big amounts of texts in a short time and retaining the most information out of them. Yet, this should not affect the testing of which presentation method helps people retain information better. Additionally, Druckman & Kam (2011) specify that one of the potential ways of overcoming this problem is using student and non-student sample to define the differences in the results (if any). Then, try to identify what caused them. Taking all this into consideration, it was decided that a student sample offers a good tradeoff between advantages and disadvantages.

1.2.1. Sample characteristics

In total 35 graduate students in Master's or PhD programs from various CEU departments (Legal Studies, Political Science, History, Gender Studies, Economics, International Relations and Medieval Studies) took part in the study The majority of participants were from the political science department, and the distribution of male and female participants was roughly equal (51.4% females, 37.1% males and 11% who did not specify their gender). In addition to that only young people aged between 18 and 40 years constituted the sample. This raises the chances of sample bias, because presumably students who study politics on regular basis are not only more knowledgeable, but also better trained in retaining politically related information. That puts generalizability of study in doubt. Furthermore, the relatively small sample size undermines the power of the further used analyses.

1.2.2. Treatments

Using the same logic of treatment selection, the two treatments used in this study were visual (infographic) and textual. With the help of a professional designer and under the supervision of data specialist, a new infographic was designed for the purposes of this study. Taking into

account the results of the pilot study, several issues that potentially affected the outcome were considered.

First, infographics by definition are an efficient presentation tool of rather complex information. Taking into consideration that environmental issue, presented in the pilot experiment, was not extremely complicated, a new issue was adopted for this study. The new topic discusses the American Federal Budget 2015. It explains some main concepts related to the budget and informs the reader about the main spending and revenue undertaken in 2015 by the American government.[9] Second, one of the hypotheses discussed in *Section 1.1.5.* of the pilot study, was that the results might have been caused by the nature of the infographic designed for the first study. Thus, in the design of this infographic, the emphasis was put on graphical elements (such as charts) and logical structure than on embellishments and beauty. Neutral colors were used for the background and stronger colors (variations of yellow and red) were used to put an emphasis on spending and revenue. Out of almost all colors, yellow is the one that attracts attention, while red raises perception. Furthermore, a certain logic was used for the design of the infographic – the information flows only vertically. Last, no embellishments and decorations were used[10].

The textual presentation was also improved for the purposes of this experiment. The textual information was designed similarly to a newspaper/magazine article, because this is the most accessible way of reaching politically related information. The same background color, as well as same font were used when designing the article-like view.[11] The length of the text was approximately 550 words, but in this study participants did not have any minimum time requirement. The idea behind this decision was that people would dedicate as much time as they need to get familiar with the text and this will depend on the interest that provoked them.

[9] This information was extracted by the U.S. government and transparency website: http://federal-budget.insidegov.com/l/118/2015

[10] Please find the infographic used in this experiment in Appendix

[11] Please find the textual treatment used in this experiment in Appendix

1.2.3. Post-treatment Stage

After exposure to the treatments, participants were asked to fill in a short knowledge test of 11 questions, covering questions related to the issue previously presented to them (such as: What does the term *Outlays* mean; What constitutes the biggest amount of total spending, etc.[12]). The questions were designed to measure the knowledge absorbed from the text.

A retained knowledge index was developed that ranges between 0 and 11 (every participant was given one point for a correct answer). Since I was the one who designed the questions, Cronbach's Alpha was used as a measure of reliability of the scale. With Alpha reliability of 0.66, the scale is very close to the threshold of 0.7. Thus, one does not have deep reasons to doubt its reliability.

After the knowledge test, participants were asked to answer few more questions. The first two of them were designed as manipulation checks, measuring if people found the presentation of the information logical and following certain order. The second group of questions was designed to measure level of interest and appeal of the information. The questions were measured on 7-point scales (from very interesting/appealing to completely uninteresting/unappealing).

Additionally, participants were asked three essay questions investigating what they liked, disliked and what they would improve in the way that the information was presented. These questions were designed to give insights of participants' opinion about the infographics; how they perceive them and what advantages and disadvantages in the presentation method they identify.

1.2.4. Results

1.2.4.1. Variables

- *Knowledge* – measured on a 11-point scale

[12] Please find all the questions of the Knowledge test in Appendix

- *Interest* (how interesting they find the information) – measured in a 7-point scale
- *Interest in additional information* – dichotomous variable (yes/no)
- *Appeal* – measured in a 7-point scale

1.2.4.2. Analysis

Among all participants, 18 were assigned to the group who received information graphic and 17 received the information as an article. Basic descriptive statistics of the main response variables, measured in ordinal scales, is presented in the table below.

Table 2: Descriptive Statistics (Lab experiment)

Variable	Mean	SD	Skew	Kurtosis	Min	Max	Valid N
Knowledge	5.86	2.10	0.22	-0.73	2	10	35
Interest	3.09	1.48	0.72	0.01	1	7	34
Appeal	3.24	1.46	0.40	0.03	1	7	34

After evaluating the skew and kurtosis of the three variables, statistical analyses can be performed with them. In order to compare the difference between the means of the variables in the different groups, Welch Two-Sample t-test was used multiple times. The results from these tests are placed in the table below.

Table 3: Results t-test (Lab experiment)

Variable	Mean in infographic group	Mean in article group	df	p-value
Knowledge	6.05	5.70	24.78	0.63
Interest	2.61	3.62	27.28	0.05*
Appeal	2.72	3.81	31.82	0.02*

Based on these results, the null hypothesis of equal means of the two populations can be rejected for the interest and the appeal variables. This means that participants found the information in the infographic significantly more interesting and appealing than the

information presented in textual format. On the other hand, the difference between the retained information in the two groups is minimal, not allowing for rejection of the null hypothesis. Interestingly, participants who received the visual treatment retained slightly more information than the once who received the textual treatment. In general, in both groups the level of retained information is relatively low (around 50% correct answers on average).

In order to test for independence between treatment and willingness to receive additional information on the topic, Chi-Square test was used. The results from the performed test do not allow for rejection of the null hypothesis (p-value = 0.3). The distribution of the answers is displayed in the table below.

Table 4: Results Chi-Square (Lab experiment)

	Willingness to receive additional information	
Treatment	No	Yes
Infographic	9	8
Textual treatment	11	5

Although the results are not statistically significant, it is noticeable that the distribution of yes and no answers in the group that received visual treatment is almost equal. Whereas over twice more participants in the group that received the textual treatment rejected receiving additional information on the topic.

1.2.5. Discussion and conclusions

The results from this experiment show that a well-designed infographic, following a certain logic pattern, could be, in fact, a very appealing way of information exposure. They could potentially also raise one's interest on the topic discussed in them. In addition, this experiment shows that participants retained slightly more information from the infographic than from the plain text treatment. Yet, this is not a strong enough evidence in favor of infographics. As a

matter of fact, the very small sample sizes could actually result in sample bias. Thus, the results from the other two experiments are of vital importance for the evaluation of this one.

1.3. Design of the online experiment

The pilot experiment was of vital importance for the whole study, as it showed that not any type of infographic could be efficient. A couple of possible explanations could be drawn from these results. The first possible interpretation is that information graphics are only efficient when they are well-structured, following a certain logic. The second possible explanation is that infographics are only efficient when they emphasize on graphics and data presentation tools such as charts, tables, maps, timelines, etc. and only contain text in bullet points. The third possible reading is that infographics are not efficient in comparison to plain text.

By adopting this design, I aim at evaluating the puzzling results from the pilot study appeared because of the nature of the infographic. Furthermore, it allows me identify which kind of infographics help people retain the most information and which design appears to be the most appealing for the audience. In case that none of the infographics helped people retain more information or happened to be more appealing, then one should conclude that textual presentation of information is the most efficient way in helping people learn.

1.3.1. The Platform

In order to test these hypotheses, the need of a new, more sophisticated design of the experiment was needed. Due to the reasons listed when introducing the first experiment, Amazon Mechanical Turk was used again as a data collection tool. The pros and cons of its usage have already been discussed.

1.3.2. Sample characteristics

A sample of 146 individuals took part in this stage of the study and were randomly assigned to three treatment conditions. Caucasian (81.5%) were overrepresented in the sample, compared to the underrepresented blacks (6.1%), and Native Americans (3%). The sample was dominated

by participants with a college degree (38.3%) and Bachelor's degree (37.6%). The distribution among men and women was almost equal (54% male participants). The most represented age groups were 18 - 25 and 26-40 (66.4%), whereas only 24.6% are above 41 years old. In these terms, the sample is not entirely representative for the whole American population because, on average, it consists of more educated people. Furthermore, on average it was composed by younger and more liberal people.

1.3.3. Pre-treatment Stage

Except for the treatments, the participants were asked to fill in a short political sophistication test. As it has been clarified in the *Chapter I: Current state of art* section of this study, political sophistication appears to have influence on how people learn and retain politically related information. My expectation is that people who were previously knowledgeable on the topic will use heuristics and biases, thus not retain as much information. On the other hand, those who were previously less-sophisticated will not have suitable schemata in which they can store the new information. Those who were in the middle, are expected to retain the most of the information, because they will already have a stored schema and will not be as biased by their previous knowledge.

To test these hypotheses and investigate the impact of previous knowledge on information retention, a short political sophistication test was developed. It was designed to measure general knowledge on the issue presented to the participants. They were asked to answer ten questions concerning the general process of adoption of the American budget (such as: Who proposes the budget bill; Who votes the budget bill; What majority can override a vetoed bill; etc.[13]). A *political sophistication* index was developed which range is between 0 and 10 (every participant was given one point for a correctly given answer). To make sure that the used scale is reliable, Cronbach's Alpha test was used to measure its reliability. With an Alpha of 0.45,

[13] All questions from the previous knowledge test can be found in the Appendix

the scale is significantly below the commonly approved 0.7 threshold of reliability (thus it could be concluded that the scale is rather inconsistent in measuring previous knowledge).

The most knowledgeable participants answered correctly to all ten political sophistication questions, whereas the least knowledgeable only gave one correct answer. As much as the scale does not measure previous knowledge consistently, it helps roughly evaluate if the participant had at least some previous knowledge on the topic.

1.3.4. Treatments

The design of the last study was adopted to test the potential hypotheses, which arose from the pilot experiment. Three potential explanations were introduced in section *1.1.6. Discussion and conclusions* and shortly at the beginning of this section. Therefore, three different treatment conditions were developed for the purposes of this experiment – two types of information graphics and a textual treatment, presented as a newspaper/magazine article. On the design of the infographics used in this study a professional designer and a data specialist worked together. As a matter of fact, the first infographic and the textual treatment were also used in student sample study[14]. Participants were randomly assigned to these three conditions. The between-person design allows the researcher to observe how the treatment effect varies between the different groups.

1.3.4.1. The difference between the treatments

In order to explain the difference between the two visual treatments and the textual one, the Mathematical Theory of Communication should be shortly introduced. More specifically, the part that focuses on quantitative measurement of information (called *entropy*). Shannon entropy measures the average expected value of information contained in a message. The unit of entropy (called *bit*) is based on the uncertainty of a fair coin flip. Thus, entropy is also a

[14] Please find them in Appendix (Infographic presented in Footnote 5 and Textual treatment presented in Footnote 6).

measure of uncertainty (measure of surprise). The lower the level of uncertainty is, the lower the entropy is. Every time one moves away from uncertainty and introduces predictability, the entropy must go down.

In that sense, *infographic one* has zero entropy, because the possible outcome of a direction in which the information flows is certain. I*nfographic two*, on the other hand, has more entropy, because the possible outcomes of directions in which the information flows are many. The *textual treatment* has also very low entropy in comparison to *infographic two*. To put it differently, since the first infographic and the text follow a certain logical pattern and the information only flows vertically, their entropy is low. Since the second infographic does not flow in a predictable, thus, logical way, its entropy is high.

With regard to the level of decorations used in the design of the three treatments, *infographic one* and *textual presentation* do not consist any decorations, whereas *infographic two* is embellished in comparison to the first two. In addition to that, *infographic one* consist more visual elements (donut charts) than both, *infographic two* and *the text*. The differences between the two treatments are summarized in Table: Differences between treatments.

Table 5: Differences between treatments

	Infographic 1	**Infographic 2**	**Plain text/Article**
Entropy (High)	×	✓	×
Entropy (Low)	✓	×	✓
Decorations (Yes)	×	✓	×
Decorations (No)	✓	×	✓

1.3.4.2. The similarities between the treatments

The same color scheme was used for the design of the infographics and the article-like formatted text (same background colors and same accent colors). Additionally, the same font

and font size were used for the three items. This is to make the information similar and ensure that participants in each group will have the same visibility to the information.

1.3.5. Post-treatment Stage

Right after the treatment, participants were asked to answer two manipulation check questions. As clarified in the previous section, the main difference between the three treatments is the way that information was structured and flows. Therefore, the questions were designed to measure the way that participants perceived the information which was presented to them (if they find it easy to be followed and if it is presented in an orderly manner). These variables were measured dichotomously (yes/no answers) and were used as manipulation checks.

Again, after the treatment was presented, a short knowledge test and a short questionnaire were given to the participants. The knowledge test, again, consists of questions covering the information presented in the treatments. It was discussed in detail in *Section 1.2.3*, when introducing the design of the lab experiment. The participants, who retained the most information, answered all eleven questions correctly. On the other hand, the participant, who retained the least, only answered one correct answer.

In addition to that, the same questions were presented, designed for the purposes of the pilot study and given to the participants of the first two experiments, measuring the general appeal of the information and interest in 7-point scales.

1.3.6. Results

1.3.6.1. Variables

The variables used for the analysis are:

- *Political sophistication* – measured on a 10-point scale;
- *Interest* – measuring interest in the presented topic in a 7-point scale;
- *Interest in additional information* – dichotomous variable (yes/no), measuring participants interest in receiving additional information on the topic);

- *Appeal* – measuring level of appeal of the information in a 7-point scale;
- *Gained knowledge* – measured in an 11-point scale;
- *Time* – measured in seconds, showing how much time was used by the participants to get familiar with the presented information

1.3.6.2. Analysis

As already specified, 146 individuals participated in this stage of the study. On basis of time spent on the treatment, 25 participants were excluded from the sample. The reason was that they only took 29 or less seconds on the treatment page; time, insufficient to read or at least skim this amount of information. This left me with a sample of 121 participants in total. 37 participants were assigned to the treatment group of the **structured infographic** (SI)[15]; 31 received an **unstructured infographic** (UI) and 53 – **article**/plain text (PT).

The table below displays the descriptive statistics of the main response variables selected for this study. As it becomes feasible, the variables are close to normally distributed, with an exception for the time variable. Thus, no further analyses will be performed on it.

Table 6: Descriptive statistics of the main variables

Variable	Mean	SD	Skew	Kurtosis	Min	Max	Valid N
Political sophistication	6.65	1.61	-0.51	0.38	1	10	121
Interest	3.25	1.65	0.43	-0.68	1	7	121
Appeal	3.07	1.41	0.59	-0.59	1	7	121
Gained knowledge	7.55	2.45	-0.13	-1.15	3	11	121
Time	160.52	178.71	6.22	50.34	30	1753	121

The first response variable, included in the analysis, is *interest* of the presented information. One-way ANOVA was used to test the difference between the means of the three different

[15] Here on structured infographics referred as SI; unstructured infographics as UI and plain text/article as PT

treatment groups. With means of 2.97 (SI), 3.22 (UI) and 3.45 (PT), F-value of 0.91 and a p-value of 0.4, it can be concluded that there is no statistically significant difference between the tree groups. Yet, the results show that on average the information was mostly interesting for those in the SI group and least interesting for the PT group.[16]

The second response variable is *interest in receiving additional information* on the topic. Since it was measured dichotomously (yes and no categories), Chi-Squared test was used to test the data independence. With a p-value of 0.61 there is not enough evidence for rejection of the null hypothesis (of independence). Thus, it could be concluded that the variables are independent from each other.

The third response variable of interest is *appeal* of the information. Again, One-way ANOVA test was performed to measure the difference in the means of the three groups. Means of 3.02 (SI), 3.19 (US) and 3.01 (PT), F-value of 0.16 and p-values of 0.8 do not provide enough evidence to reject the null hypothesis of equal means.

The last response variable important for the analysis is *gained knowledge*. In order to test for difference in the means of the three groups, One-way ANOVA test was used, once again. A p-value of 0.2 (and F-value of 1.26) does not provide me with enough evidence that the three means 7.21 (SI), 7.25 (UI), 7.9 (PT) differentiate on statistical level. Still, it becomes clear that, on average, people in the PT group retained the most from the presented information, which confirms the results from the pilot study.

For the purposes of this part of the analysis, the results from the manipulation checks were used. Since it was of a vital importance for the success of the experiment people to be perceive the information in the three treatment conditions differently, those for whom the manipulation did not work successfully were excluded from the sample. For this sake, participants in UI

[16] **NB:** Please note that when coding the variables of interest **"Very interesting"** was coded as **1**, whereas **"Completely boring"** was coded as **7**. The same pattern was used also when coding the appeal variable. Thus, a mean closer to 1 means that on average certain way of presentation was rather positively evaluated by the participants.

group who answered positively to both of the manipulation check questions were excluded. Further, participants who gave negative answers to either of the manipulation check questions in the SI group were also dismissed. The last was also performed on the PT group. This only left me with a sample of 84 participants who were distributed among the samples as following: 26 in SI group; 15 in UI group and 43 in PT group.

The exact same tests were performed on the variables after excluding the unsuccessfully manipulated participants from the sample. The results are summarized in the table below.

Table 7: ANOVA results (Online experiment)

	Mean	**SD**	**F-value**	**p-value**	**Valid N**
Interest variable			3.13	0.049*	
SI group	2.76	1.36			26
UI group	4.06	1.86			15
PT group	3.23	1.63			43
Appeal variable			9.45	0.0003***	
SI group	2.30	0.88			26
UI group	4.00	1.69			15
PT group	2.74	1.19			43
Knowledge variable			3.27	0.04*	
SI group	7.61	2.04			26
UI group	6.13	2.06			15
PT group	7.93	2.60			43

Due to the very small sample size of the UI group, outliers that could potentially affect the results were checked for, but no extreme values were found. As it becomes clear, participants found the information presented in the structured infographic not only the most appealing one, but also the most interesting. The second most appealing and interesting was the information presented as plain text (formatted as a magazine article). As it was hypothesized, the least interesting and least appealing was the information presented in an unstructured infographic. Not only did they not like it, but they also did not learn the least from it. Again, participants in

the textual treatment group learned the most. The difference between it and the SI group is minor though. In general, the small sample sizes and the inequality in the group sizes hinder the power of the analyses used.

For the *interest in additional information* variable, the Chi-Squared test of independence was performed, showing a p-value of 0.07. and x-squared of 5.05. Yet, the credibility of these results could be doubted because the frequency distribution in one of the cells was significantly lower than 5.

For the last part of the analysis, participants were divided into three groups according to the results of the political sophistication that they gained. Those who scored 5 or below points were placed in the group of "Novices"; those who scored 6, 7 or 8 were allocated into the "Medium" group; the rest formed the group of the "Political sophisticates"[17]. By doing this, the effect of previous knowledge on retaining new information could be assessed. In order to do so, One-way ANOVA analyses were performed. The results from them are placed in the table below.

[17] The decision to divide the participants like this was twofold. First, some of the questions in the questionnaire were relatively easy (such as the question about vetoing the budget bill). Second, on average the participants in the mTurk pool is more educated (respectively knowledgeable), thus, the threshold for the least sophisticated group was put higher. In addition, this allowed for roughly equal group sizes (with an exception for the textual treatment group).

Table 8: ANOVA results (Previous knowledge variable)

	Mean	SD	F-value	p-value	Valid N
SI group			2.96	0.06 .	
Novices	6.18	2.56			11
Middle	7.07	2.30			14
Political sophisticates	8.33	1.37			12
UI group			5.64	0.008**	
Novices	5.40	1.77			10
Middle	8.07	2.05			13
Political sophisticates	8.25	2.60			8
PT group			1.61	0.2	
Novices	6.57	2.57			7
Middle	7.84	2.50			26
Political sophisticates	8.55	2.56			20

Clearly, those who were previously least knowledgeable learned the least. On the other hand, the difference between the middle group and the schematics group was not as pronounced. These results support the expectations that those who were in the middle would retain the most out of the information. This could be concluded from the minor differences between the means of the top two groups. Yet, the very small sample sizes and the big differences in between the size of the groups undermine the power of the analysis. Thus, any statistical inferences in that case will be hard to make.

1.3.7. Discussion and conclusions

A few issues arise from the results and are worth discussing. First, the previous knowledge results will be shortly evaluated. As the literature suggests, previous knowledge on the topic does matter. Unfortunately, people who were previously least sophisticated on the topic, retained the least amount of new information. Still, the knowledge gap between the group in the middle and the "Schematics" was not too deep. In addition to the, the biggest difference between the three political sophistication groups was detected in the group who received the

PT treatment. Yet, this group was on average the most knowledgeable one, since none of these participants scored below 5 in the political sophistication test. This could potentially explain why the individuals in this group (as a whole) retained more than the participants in the SI group.

First, the results from this experimental study could only be inferred to those people who clearly distinguish between the different type of infographics and information presentation types (those who saw a clear structure in the first infographic and those who failed to see it in the second one). This is, of course, limiting up to a certain point, but also gives a clue that not every type of infographic will be as efficient. As hypothesized, the infographic with low entropy is the lease effective presentation tool. People who received it did not only extract the least information out of it, but also did find the least interesting and least appealing. Interestingly enough, people tend to learn the most from plain text, but find structured information graphics the most appealing way of presenting information. By this, they also raise the level of interest on the topic. These results present a very interesting tradeoff between gaining more knowledge and making people interested in politically related information. Presumably, those who are generally uninterested in politics will simply skip it. On the other hand, if it is presented in an appealing way, they might pay attention to it. In addition to that, effective infographics have potential to raise interest in information presented in them. So, an interesting puzzle was formed by these results – should we choose the more effective way to learn or the more effective way to enhance people's interest in political information?

To sum up, information graphics are somehow similar to Donald Trump's campaign – spectacular, but empty of meaning. Except that infographics actually transmit knowledge (after all the difference between the groups were not significant). In fact, participants who commented on the essay questions emphasized on the fact that they appreciate the visualizations used and positively evaluated the colors (in comparison to the "boring" black

and white textual presentation). Some of them commented on the text and the unstructured infographic that the emphasis should be on more visual elements and less words. One potential problem from this is that not every type of information could be efficiently visualized. Yet, the implication of infographics as a dominating presentation tool of political information is worth considering.

1.4. Design of the candidate experiment

This last experiment is testing how people evaluate candidates presented in a normal voting pamphlets versus candidates presented in infographics. Due to their high visual emphasis, the last are more appealing than plain text. As it was previously discussed, people perceive the world around first visually. Thus, a possible implication of infographics for the purposes of political and candidate campaigning was worth considering and testing. With the results from the previous experiments, which indicated that certain types of infographics appear to be more appealing than plain text, their potential usage for candidate campaigning was considered even more serious.

1.4.1. Cognitive processing models of candidate evaluation

Two main models dominate in the literature of candidate processing and evaluation. The first one presumes that individuals form their candidate evaluations on-line with the encountering of the candidate information. This model is also known as the impression-driven model (Lodge & Steenbergen, 1995; Lodge et al.,1989; McGraw et al.,1990). These authors clarify that due to the on-line evaluation of the candidates, people do not need to use any information previously stored in their memory.

As opposed to this model, the memory-based processing model proposes that opinion about candidates are formed after specific information about the candidate is being extracted from the long-term memory and combined with the new information to form a generalized evaluation (Zaller, 1992; Zaller & Feldman, 1992). Yet Lavine (2002) and McGraw (2003)

gather that the literature on the topic so far (which mostly includes experimental studies) mainly advocates in favor of the first model[18].

On the other hand, Knight (1985), Jacoby (1986), Stimson (1975) argue that political sophistication is related to the extent in which individuals use party and ideology affiliation in the formation of their candidate preferences. Politically sophisticated individuals also are able to follow more sophisticated and efficient information-processing strategies (Fiske & Kinder, 1981). They do not use information from their memory in order to make their evaluations and rely mainly their judgments on the information that they are processing on-line (McGraw et al., 1990). On the contrary, the politically less sophisticated tend to rely on memory-based processing when making their evaluations. In addition to that, they use personally important issues when assessing candidates (McGraw et al., 1990).

Since the literature on the topic is relatively inconsistent, it is interesting to evaluate how sophisticated versus less sophisticated individuals make their voting decisions based on the candidate presentation format (infographic or a candidate pamphlet), as well as on their previous political sophistication. This was tested in the experiment described below.

1.4.2. Why an American sample?

This experiment was fielded using the same platform as before (Amazon Mechanical Turk). It is an appropriate decision to test these hypotheses on an American sample, because the implementation of information graphics in candidate campaigning could be very useful for the American purposes of campaigning. In a majoritarian system in which the individual candidates are as important as the party affiliation, it is of vital importance for the candidates to present themselves in the most appealing possible way.

[18] Basically, the conclusions made by these authors are that evidence from the literature points out that candidate evaluations are made primarily on-line. On the contrary, policy opinion formations are mainly made using the memory-based model. The exceptions to this are Redlawsk (2001); Lay & Redlawsk (2006); Mitchell (2008)

In order to test them, a new experimental design was developed. The experiment had two stages. In the first stage of the experiment participants were asked about their party affiliation. According to the answer of this question, they were randomly assigned to different treatment conditions. For instance, Democrats would only receive Democratic candidates, whereas Republicans would only be presented Republicans.

For the success of this study it is of extreme importance to be controlled for partisanship, as a Democrat would not simply vote for a Republican no matter how appealing the last is presented (and vice versa). On the other hand, the decision to exclude Independents from the scope of this experiment, might enhance external validity. Yet, the spectrum of political views, covered in the group of Independent individuals, is extremely wide, as Independents might be on the political left, center or right. Since the goal of this last experiment is to determine the difference in the way people perceive and evaluate candidates presented in a different manner, there is no reason to believe that this would be different for the Independents only. Thus, excluding them from the sample is a decision that is worth making.

1.4.3. Sample characteristics

A non-probabilistic sample of 133 eligible to vote in the United States participants was randomly assigned into the two treatment conditions (candidate information in an infographic and in a voter's pamphlet). McGraw (2011) claims that little theoretical knowledge exists, which gives a reason to argue that the basic cognitive processes of impression forming and candidate evaluating is different across samples. She, further, explains that theoretically speaking, what makes a difference between individuals are mainly the different cognitive abilities and the level of political sophistication.

The sample is equally represented in terms of gender (51% males). Among them 43% are Democrats (the reason for excluding Independents and other partisan affiliations was explained already). Again, participants with college and Bachelor's degrees constituted the largest part

of the sample (71.3%). When it comes to the age of the participants, more than a half of them are between 18 and 40 and only 8.3% are above 56 years old.

1.4.4. Pre-treatment

In the first phase of the experiment, participants were asked about their party affiliation and their eligibility to vote in the United States of America. In case they successfully passed this stage, they were presented a short test, which was designed to measure their knowledge about the party they support. The questions in the partisan knowledge test covered general knowledge about the party and its image (such as: What is the symbol of the Democratic/Republican party; What does the term Red/Blue state mean, etc.); knowledge about the policies that their preferred party supports (such as: What kind of healthcare policies do the Democrats/Republicans usually support); but also on current and previous party leaders (Who is the current leader of the Democratic/Republican party in the House of Representatives (Minority/Majority Leader), etc.). It was important to include questions measuring not only knowledge about the vision of the party (in that sense to simply recognize the color of the party and its symbol), but also on the policies that it pursuits, because a truly knowledgeable person would know what policies she is casting her vote for. Controlling for sophistication in the field is important, as it was previously clarified that this variable is an important moderator.

Following Lodge and Hamill (1986) a decision was made to assign them to three different categories, based on their previous knowledge about the party. In total they were required to answer eight questions. As the last one of them has three correct answers, the maximum result one could score, was 10. Participants were given one point for a correct answer, but also taken one point for a wrong answer to the last question, thus, the least possible score was -3.

A partisan knowledge index was developed with a range between -3 and 10. The three possible categories, adopted from Lodge and Hamill (1986), into which the participants were divided were Partisan sophisticates, Partisan novices, and a middle category. In order to be classified

as a Partisan sophisticate one must have given 9 or 10 correct answers to the questions. The Partisan novices scored 6 or less on the partisan test. The rest were automatically allocated to the middle category.[19]

1.4.5. Treatments

The first treatment condition is information about a candidate from the preferred party, presented in a regular voter's pamphlet[20]. The treatment presented to the second group was the same candidate with the same personal information, presented in an infographic. It is expected that the combination of good structure, appeal and small partisan cues, would make a successful combination making the candidates more appealing for the voters[21].

For the design of the infographic of the two candidates, the colors usually associated with the party were used. Thus, the Republican candidate was presented in an infographic with a red theme color, whereas for the Democrat, blue color theme was implemented. The idea behind that was to provoke stronger partisan feelings and provide the participants with stronger partisan cues.

The information for both – the Republican and the Democratic candidate, presents issues typically known to be supported by their own party. For instance, the Democrat' platform discusses programs and policies like No Child Left Behind, child care, paid leave, retirement security, social security, Meals on wheels. Whereas the Republican in his platform stands against the growth of bureaucracy and supports lowering of taxes for low and middle income, advocates cutting costs of government, and defends the second amendment and ownership of land by state's people.[22]

[19] Since the test was relatively easy and most of the participants scored highly on it, the three categorizations had to be adjusted. By dividing the participants in the chosen way, this allowed for almost equally sized groups: 43 participants were classified as Novices, 47 were allocated in the middle category and 43 in the group of the Sophisticates.

[20] Please find Treatment 1 (Candidate in pamphlet) in Appendix

[21] Please find Treatment 2 (Candidate in infographic) in Appendix

[22] For the design of the treatments a picture of a male candidate was needed. Prof. Wolfgang H. Reinicke (Central European University) kindly consented his photograph to be used for the purpose of this study.

1.4.6. Post-treatment Stage

After being exposed to the treatment conditions, participants were asked to answer a couple of questions, designed to measure how appealing they found the information and how they liked the way that the information was presented (measured in 7-point scales). In addition, a very short test about the candidate's platform (four questions) was designed to measure the absorbed knowledge. The first three questions had one correct answer and the last one had three. Participants were given one point for a correct answer and taken one point for a wrong answer to the last question. Thus, the maximum that a participant could score was six points and the least was -3. A *retained knowledge* scale was developed, ranging from -3 to 6. The last question, which the study participants were asked to answer was if they see themselves voting for the candidate.

After finishing with all questions batteries, participants were provided with a disclaimer, in which it was clarified that the previously presented candidate was fictitious, reassuring them that the study would only be used with non-partisan, but only academic purposes.

1.4.7. Results

1.4.7.1. Variables

The main variables used for the analysis are:

- *Previous knowledge* – measured in a 13-point scale (from -3 to 10)
- *Presentation evaluation* – measured in a 7-point scale
- *Candidate information appeal* – measured in a 7-point scale
- *Voting intention* – dichotomous variable (yes/no)
- *Knowledge about the candidate* – measured in a 10-point scale (from -3 to 6)

1.4.7.2. Analysis

As the participants were randomly assigned to the two treatment conditions, 63 received candidate information presented as a candidate pamphlet and 70 received it in an infographic. In order to further continue with any kind of statistical analysis, the distribution of the variables should first be examined. *Table 9: Descriptive Statistics* displays the basic descriptive statistics of the main variables of interest (find below).

Table 9: Descriptive Statistics (Candidate experiment)

Variable	Mean	SD	Skew	Kurtosis	Min	Max	Valid N
Presentation evaluation	1.66	1.19	-0.71	0.11	-2	3	133
Appeal	1.77	1.05	-0.29	-0.87	-1	3	133
Knowledge	3.30	1.66	-0.52	-0.19	-1	6	121

The values for skew and kurtosis reassure that the distribution of the variables is relatively close to normal. Thus, further analyses can be performed. For the three variables presented in the table above, Welch Two Sample t-test was performed in order to identify a difference between the means of the two treatment groups. The results are summarized in *Table 10: Results t-test.*

Table 10: Results t-test (Candidate experiment)

Variable	Mean in group Infographic	Mean in group Voter's pamphlet	df	p-value
Presentation evaluation	1.77	1.53	129.81	0.25
Appeal	1.95	1.57	129.89	0.03*
Knowledge	3.24	3.36	128.51	0.66

When it comes to the first variable, *presentation evaluation* means of 1.77[23] (infographic group) and 1.53 (voter's pamphlet group) and a p-value of 0.2 show that the null hypothesis of equal population means cannot be rejected. Yet, the presentation in an infographic was slightly higher evaluated. On the other hand, the difference with a p-value of 0.03, one could conclude that participants in the group who received infographic found the information about the candidate significantly more appealing than the one who received the voter's pamphlet. Last, those who received the pamphlet remembered more information about the candidate than those who received the infographic (but the difference between the two means is very slight). This does not come as a surprise, taking into consideration the results of the previous experiments.

In order to test if the method of presentation influenced the way in which participants intended to vote (for or against the candidate), a Chi-Square test of independence was used. A p-value of 0.68 does not provide enough evidence to reject the null hypothesis of independence. Thus, it can be concluded that participants' choice on whether or not to cast a vote for the candidate, is not based on the way in which the candidate information was presented to them.

In this last part of the analysis, the previous knowledge variable was also included. A hypothesis that will be tested is whether previous knowledge affects the way in which participants use clues in candidate presentation. The expectation is that people who were previously less sophisticated will tend to base their voting decision on appeal, whereas more sophisticated people will be using more complex evaluation criteria. For the sake of the analysis, Chi-Square test of independence was used again. With a p-value of 0.18 the null hypothesis of independence cannot be rejected. Yet, from the contingency table below it becomes evident that in fact more people in the Partisan novices group answered negatively to the voting intention question. Which means that less knowledgeable people did not base their

[23] **NB:** Please note that when coding the data, **Liked it very much category** was coded as **3**, whereas **Completely disliked it** was coded as **-3**. Same logic was applied when coding the appeal question. Thus, the higher the value of the mean – the positive the evaluation.

voting decision on partisan cues. The results from this analysis are summarized in *Table 11: Results Chi-Square test*.

Table 11: Results Chi-Square test (Candidate experiment)

Voting for the candidate	Infographic group	Voting pamphlet group
		Partisan novices
No	9	6
Yes	18	14
		Middle group
No	9	7
Yes	15	12
		Partisan sophisticates
No	2	3
Yes	17	21

A further analysis of the knowledge about the party of preference is worth being discussed. For this purpose, one more Chi-Square test of independence was used to test for independence between the knowledge and voting decision. With a p-value of 0.018* there is enough evidence for rejection of the null hypothesis. The contingency table (*Table 12: Results Chi-Square*) resulting from the test is placed below.

Table 12: Results Chi-Square (Previous knowledge)

Voting for the candidate	Partisan novices	Middle group	Partisan sophisticates
No	16	15	5
Yes	27	32	38

Clearly, more participants from the top group were willing to cast a vote for the candidate than in any other group. Those who knew the least about the party tended not to cast vote for the candidate.

1.4.8. Conclusions

A couple of important takeaways could be extracted from this experiment. First, infographics may not be so powerful to make someone cast a vote for a candidate, but they certainly present candidates in a more appealing way. Second, just like the results from the previous experiment showed, previous knowledge matters. In the context of voting behavior, participants who are most knowledgeable about their parties would support a candidate from their party no matter what. In that case, one should consider how to send the most appealing message to those who are not party affiliated. From the results that this experiment performed, it could be concluded that infographics could be an efficient tool for transmitting a more appealing message to the voters. Thus, their implementation in individual candidate campaigning is worth considering.

Of course, these results should not be taken into consideration without acknowledging the limitations of the experiment. One of the main ones is the fact that the sample was dominated by relatively young, liberal, educated people. The sample bias might be the reason of the current results. If, for instance, information graphics are more appealing to young people, this undermines the power of the conclusions. Thus, it is important that further research focuses more precisely on the implication of infographics and this study is replicated, using a more representative sample.

Conclusion

In my thesis I studied the potential implication of infographics as information visualization tools for the purposes of political campaigning. More precisely, three characteristics of information graphics were evaluated. First, their level of appeal (in comparison to plain text) and potential to increase interest in political information. Second, their potential to enhance political knowledge (as opposed to plain text) using their power as an education tool. Third, their role as a political candidate presentation tool (in contrast to regular voters' pamphlets). The main expectations were that information graphics would show to be more efficient in increasing interest in political information (using their high level of appeal); in enhancing political knowledge (by emphasizing on visual elements); and augment the likelihood of electing a candidate (by enhancing her appeal).

The results from the four experimental studies conducted identified a few tendencies. Fist, not simply any kind of information graphics are efficient. Only infographics with a clear logical structure and simplistic design appear to attract individuals' attention. Second, well-structured infographics are more appealing and more efficient in increasing individuals' interest in political information than plain text. Third, it can be concluded by the results that infographics are not a more efficient in helping people retain more information than plain text. Yet, the results for this variable are inconsistent among the conducted experiments and most of them did not show any statistical significance. Last, it was found that candidate's presentation in an infographic cannot enhance her chances to get elected, but it certainly does present her in a more appealing way.

It is important to be noted that these results cannot be evaluated without taking into account the limitations that this study is facing. Most of them arise from the fact that experimental design was adopted and the hypotheses were tested using convenient samples. Although

experiments help in detecting causal relationships and provide researchers with control over the participants, they go hand in hand with problem of external validity. In the case of the current research it is augmented by the convenience of the samples, but also by the fact that the experimental environment did not fully overlap with reality. Furthermore, mTurk samples are hardly representative of the whole American population. In addition, inferences from student samples are tough to be drawn.

The method and samples selection hinder the generalizability of the results and the potential of the contribution. Still, it is certain that the implementation of infographics in the context of political science has not been researched previously. Their usage for the purposes of presentation of political information and political candidates might have potential effects. First, although no evidence was found that infographics can help in increasing political knowledge, results showed that they are appealing and increase interest. This of a vital importance. Unfortunately, people are generally not interested in political information. A major challenge for information campaigns is targeting people who have no interests in politics. Information graphics have the potential to help in this effort. Second, when speaking of candidate campaigning, the application of infographics is something which is certainly worth a shot. In a world where people know little about politics, candidates and parties, and information flows from every direction, an appealing way of presentation might result in additional votes. It would be very interesting if one day (and maybe this day will come very soon) information graphics get implemented in candidate campaigns.

The importance of infographics has been growing over the last several years and will potentially continue to grow, because they satisfy our natural need to perceive information visually. Infographics go hand-in-hand with the information transformation through which we are living. Individuals want information in short bits, which are quick to acquire and give an

impression of knowledge. Their implementation into the field of politics should be carefully considered and, of course, furtherly investigated. Their efficiency for the purposes of campaigning should be tested on more representative samples, adopting different methodologies and more sophisticated research designs in order to make the most of their usage.

Appendices

Appendix A: Treatments for Pilot Experiment

Textual treatment used in the pilot study

Solutions to Global Warming in North America

Solutions to global warming in North America include reducing coal emissions, increasing the use of energy efficiency and renewable energy, greening transportation, and helping developing countries reduce deforestation.

The North American region includes the United States and Canada, which rank number two and seven, in CO2 emissions globally (using 2008 data). The United States and Canada also have very high per capita emissions.

The United States.

The United States is often noted as the being the most significant contributor to historical emissions of global warming pollution. Most of these emissions occur when power plants burn coal or natural gas and when vehicles burn gasoline or diesel.

According to the U.S. Energy Information Administration the sources of U.S. Heat-Trapping Emissions in 2008 came from Transportation CO2 (19%); Non-CO2 Emissions (13%); Industrial CO2 (18%); Commercial CO2 (12%); Residential CO2 (13%); Electricity CO2 (25%).

The National Academy of Sciences released a series of reports (2010) emphasizing the urgency of climate change and why the U.S. should act now to reduce emissions of heat-trapping gases. "The longer the nation waits to begin reducing emissions, the harder and more expensive it will likely be to reach any given emissions target."

Analysis performed by the Union of Concerned Scientists has demonstrated that the U.S. can dramatically reduce its reliance on fossil fuels and nearly phase-out coal by 2030 while saving consumers and businesses money by investing primarily in energy efficiency and renewable energy.

There are concrete actions that citizens, businesses and policymakers can take to reduce global warming emissions. Experience has shown that government policies are critical to spurring and enabling global warming solutions and that individual actions alone will not solve the problem. While comprehensive climate and energy legislation has thus far failed to pass the United

States Congress, there are a series of vital programs and strategies underway in the United States to reduce global warming emissions, such as:

- Elevating energy efficiency;
- Promoting renewable energy;
- Reducing coal emissions;
- Greening transportation, etc.

Questionnaire and Knowledge Test

Questions
1. Which place did the United States occupy in 2008 in CO2 emission ranking?
a. Fourth
b. Second
c. Seventh
d. Eight

2. Which of the emissions generates the largest share of pollution?
a. Commercial CO2
b. Non-CO2 emissions
c. Industrial CO2
d. Electricity CO2

3. By which year can the United States reduce fossil fuels and nearly phase-out coal according to the Union of Concerned Scientists?
a. 2035
b. 2040
c. 2030
d. 2045

4. What does postponing of problem solving cause?
a. Makes it impossible to solve
b. Makes it more expensive to solve
c. Does not make any difference
d. Saves businesses and consumers' money

5. Who can solve the problem?
a. Governments and policymakers
b. Businesses and citizens
c. Legislation, citizens and businesses

6. How can global warming emissions be reduced?
a. They cannot be reduced by the governments
b. They can be reduced by promoting renewable energy and elevating energy efficiency
c. They can be reduced by citizens when recycling

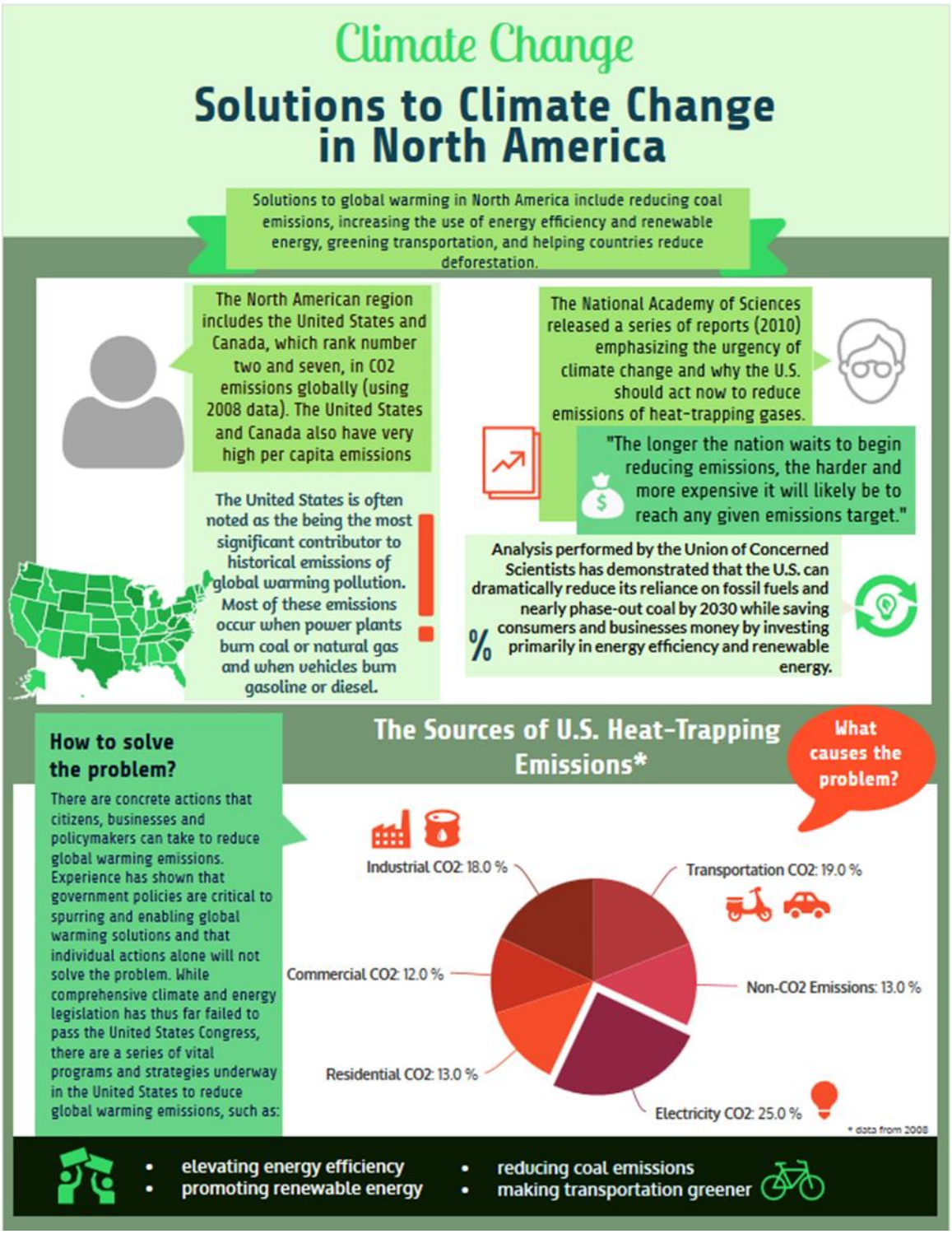
7. How interesting did you find the information?
a. Very interesting
b. Rather interesting
d. Interesting
e. I am indifferent
f. Boring
g. Rather boring
h. Very boring

8. How much would you be interested in receiving additional information on the topic?
a. Very interested
b. Rather interested
d. Interested
e. I am indifferent
f. Uninterested
g. Rather uninterested
h. Completely uninterested

9. How important do you think climate change is?
a. Very important
b. Rather important
d. Important
e. I am indifferent
f. Unimportant
g. Rather unimportant
h. Very unimportant

10. How important do you think it is to be acted upon resolving the problem?
a. Very important
b. Rather important
d. Important
e. I am indifferent
f. Unimportant
g. Rather unimportant
h. Very unimportant
11. How did you like the way that the information was presented?
a. Very much
b. Rather liked it
d. Liked it
e. I am indifferent
f. Disliked it
g. Rather disliked it
h. Completely disliked

Visual treatment used in Pilot Study



Appendix B: Treatments for Online and Lab Experiments

Plain Text Treatment

2015 UNITED STATES BUDGET

2015 Key Facts

The U.S. government collected $2.96T in tax revenues and spent a total of $3.36T in its 2015 budget, resulting in a deficit of $399B that year. The deficit was 2.5% of its total GDP of $16.2T in 2015. The total revenues were $2.96T and the total spending $3.36T.

Budget over Time

Receipts (or revenues) are funds flowing into the U.S. Treasury from such things as individual and corporate income taxes, payroll taxes and user fees.

Outlays (or expenditures) are money paid out by the U.S. Treasury; they occur when obligations are actually paid off, primarily by using checks or making electronic fund transfers.

In order to have a balanced budget, a budget's receipts must equal or exceed its outlays.

Revenues

Income from individual income taxes in 2015 is estimated to be about 47% of all receipts that year. This is greater than average when compared to receipts from other years (average proportion = 45%). Income tax is levied on over 100 million American households each year.

Payroll tax income is estimated to be about 33% of all receipts that year. This is greater than average when compared to receipts from other years (average proportion = 30%). Payroll taxes are taxes that employers are required to pay when they pay their staff their salaries.

Corporate income taxes are estimated to make up 11% of all receipts that year. This is less than average when compared to receipts from other years (average proportion = 14%). Corporate income tax is imposed at the federal level on all entities treated as corporations.

Spending

Spending on Social Security, unemployment, and labor in 2015 was about 38% of all outlays that year. This was far greater than average when compared to budgets from other years. (Average proportion = 35%)

Medicare and general health spending was about 28% of all outlays that year. This was one of the highest proportions spent when compared to budgets from other years. (Average proportion = 13%)

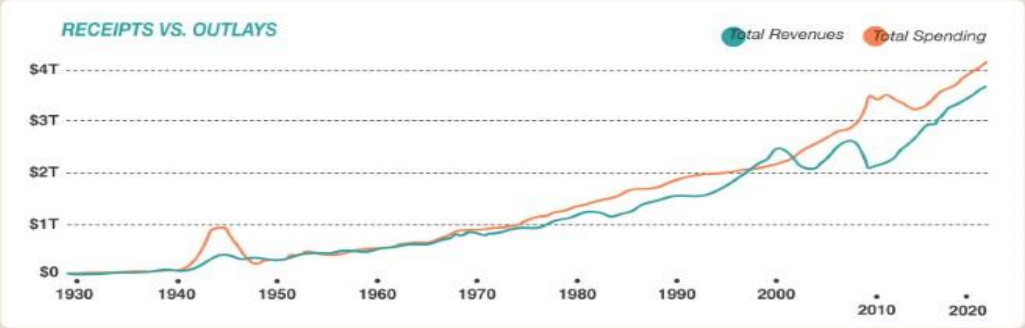
Spending on national defense was about 16% of all outlays that year. This was less than average when compared to budgets from other years. (Average proportion = 21%)

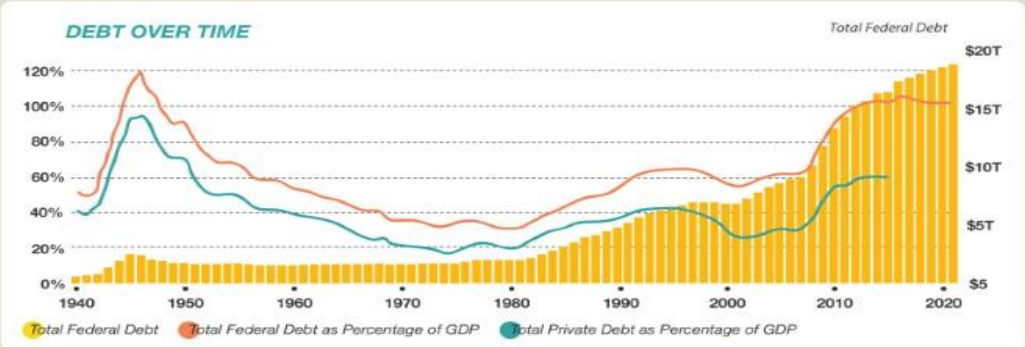
As for spending on net interest, the government dedicated about 6% of all its outlays that year to paying down its accumulated debt. This was less than average when compared to budgets from other years. (Average proportion = 8%)

All other programs (agriculture, energy, commerce and housing credit, community and regional development, etc.) made up approximately 12% of national spending in 2015.

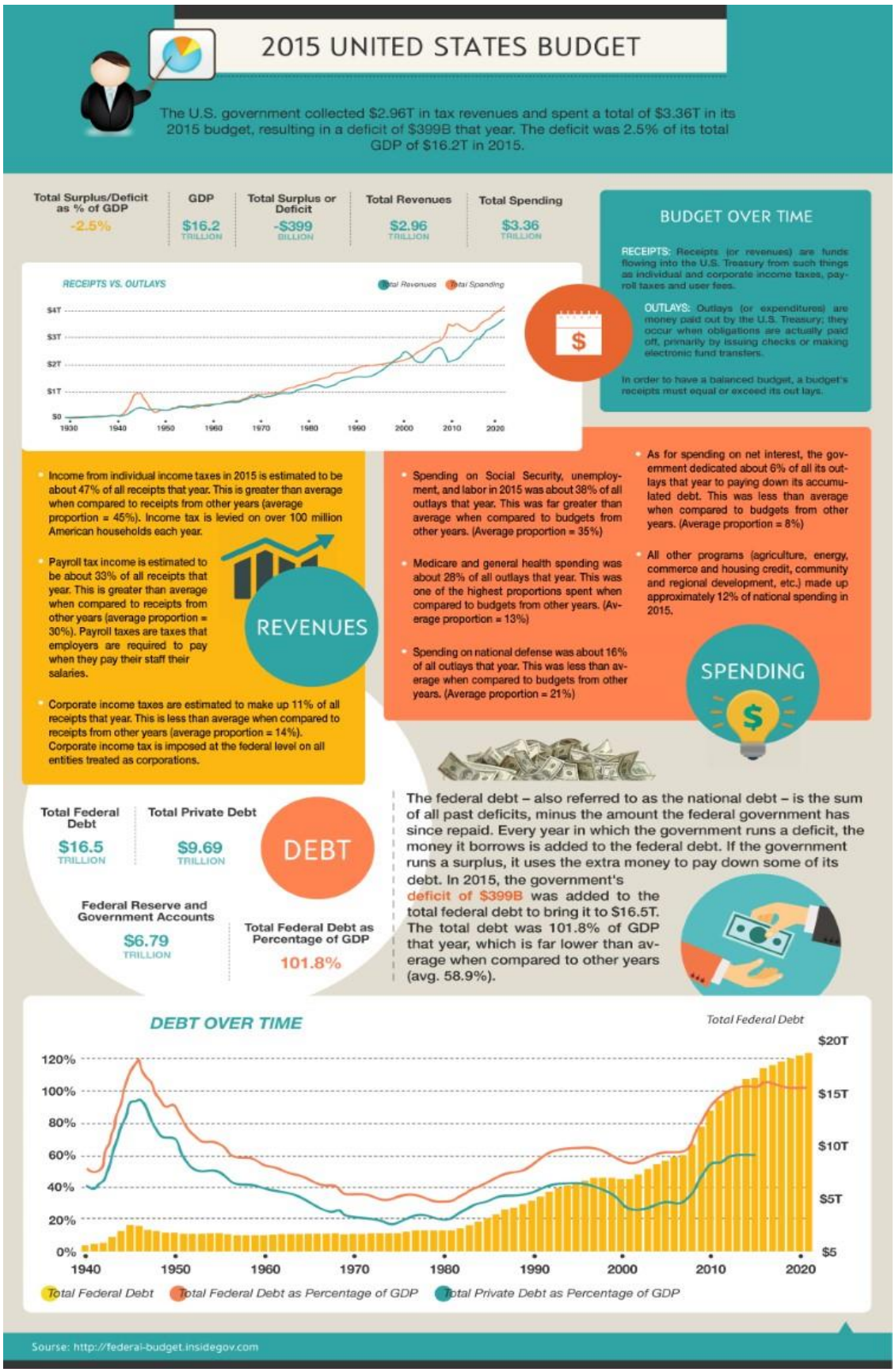
Debt

The federal debt – also referred to as the national debt – is the sum of all past deficits, minus the amount the federal government has since repaid. Every year in which the government runs a deficit, the money it borrows is added to the federal debt. If the government runs a surplus, it uses the extra money to pay down some of its debt. In 2015, the government's deficit of $399B was added to the total federal debt to bring it to $16.5T. The total debt was 101.8% of GDP that year, which is far lower than average when compared to other years (avg. 58.9%). On the other hand, the total private debt was $9.69T. The Federal Reserve was at $6.79T in 2015.

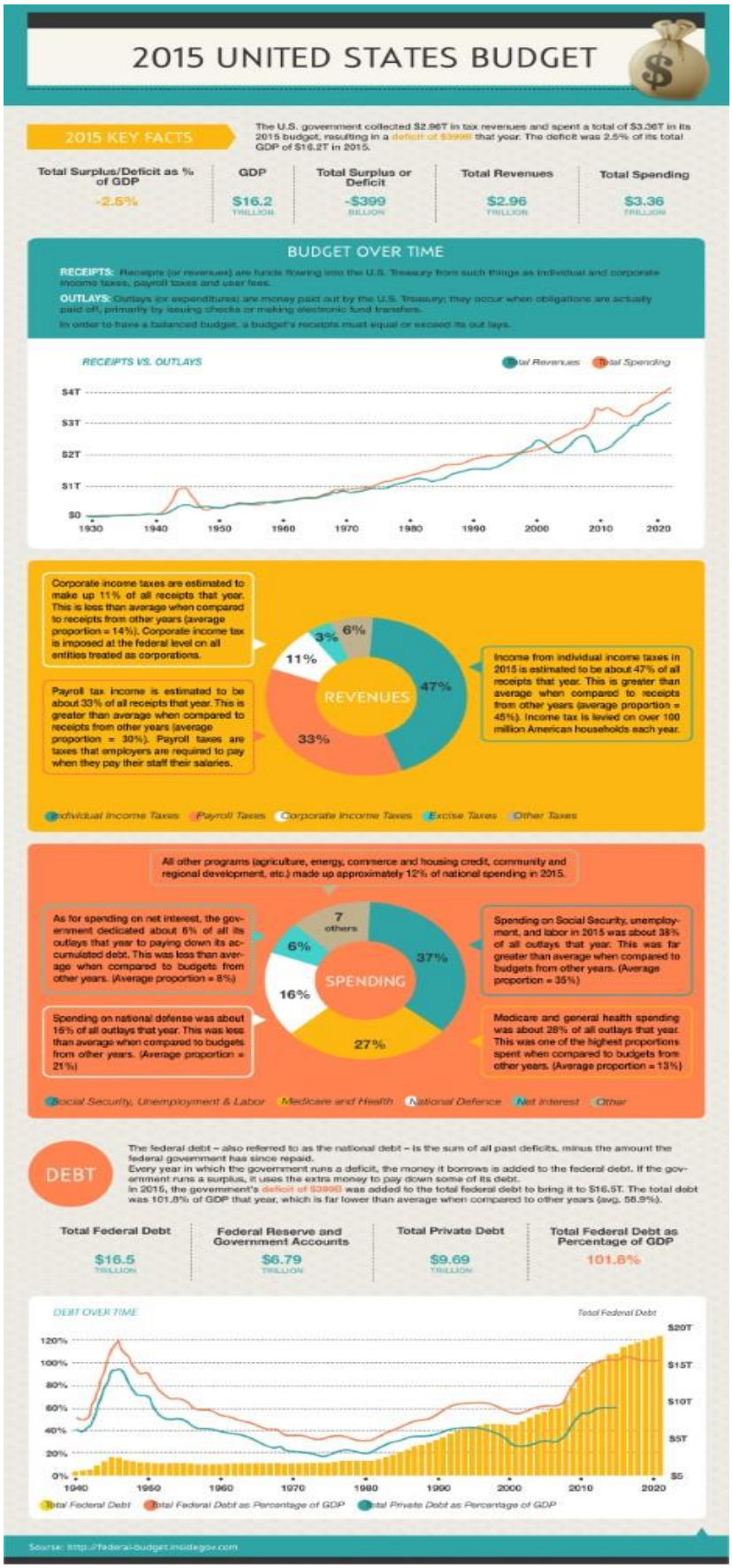




Unstructured Infographic Treatment



Structured Infographic Treatment



Previous Knowledge Questionnaire

1. Who proposes the annual American Federal Budget?
a. The Senate
b. The House of Representatives
c. The President
d. I don't know/ I am not sure

2. Who votes the annual budget?
a. The Senate
b. The House of Representatives
c. Both
d. I don't know/ I am not sure

3. Who can veto the budget bill?
a. The Senate
b. The House of Representatives
c. The President
d. I don't know/ I am not sure

4. What kind of majority in which chamber it required to override a vetoed bill?
a. Simple majority (50%+1) in the Senate
b. Two-thirds in the Senate
c. Two-thirds in each chamber
d. I don't know/ I am not sure

5. What is the Federal Insurance Contributions Act tax (FICA)?
a. A tax, payed by the employees on monthly basis
b. A tax, payed by the employers on monthly basis
c. A tax payed by both – the employees and employers on monthly basis
d. I don't know/ I am not sure

6. The federal personal income tax is?
a. A flat tax
b. A progressive tax
c. None of the above
d. I don't know/ I am not sure

7. In general, what macroeconomic principles do Democrats support?
a. Low taxes, limited regulation, small government, etc.
b. Mixed economy, private and public enterprise, welfare state, etc.
c. None of the above
d. I don't know/ I am not sure

8. In general, what macroeconomic principles do Republicans support?
a. Low taxes, limited regulation, small government, etc.
b. Mixed economy, private and public enterprise, welfare state, etc.
c. None of the above
d. I don't know/ I am not sure

9. Conceptually, who supports Medicare, Medicaid and Social Security?
a. Democrats
b. Republicans
c. None of the above
d. I don’t know/ I am not sure

10. What is Medicaid?
a. Social care program for individuals with low income
b. Social insurance program
c. Old-Age, Survivors, and Disability Insurance
d. I don’t know/ I am not sure

Knowledge Test

1. What is the deficit as % of GDP in 2015?
a. -3.6%
b. -2.5%
c. -1.8%
d. I don’t know/ I am not sure

2. What is the GDP of the United States for 2015?
a. $ 18.1 trillion
b. $ 21.8 trillion
c. $ 16.2 trillion
d. I don’t know/ I am not sure

3. What are the total revenues of the United States for 2015?
a. $ 4.75 trillion
b. $ 1.77 trillion
c. $ 2.96 trillion
d. I don’t know/ I am not sure

4. What does the term Outlays mean?
a. Funds flowing into the U.S. Treasury
b. Money paid by the U.S. Treasury
c. None of the above
d. I don’t know/ I am not sure

5. What constitutes the biggest part of the total revenue?
a. Individual income taxes
b. Payroll tax
c. Corporate taxes
d. I don’t know/ I am not sure

6. What percentage of the total revenue are the payroll taxes?
a. 25%

b. 18%
c. 33%
d. I don’t know/ I am not sure

7. What constitutes the biggest amount of total spending?
a. Spending on Social Security, unemployment and labor
b. Medicare and general health spending
c. Spending on national defense
d. I don’t know/ I am not sure

8. What percentage of the total spending are the spending on Social Security?
a. 25%
b. 38%
c. 46%
d. I don’t know/ I am not sure

9. The spending on Medicare and general health was approximately 28% in 2015. That is
a. Less than the average proportion
b. Roughly the same average proportion
c. More than the average proportion
d. I don’t know/ I am not sure

10. What happens when the government runs deficit?
a. The borrowed money is added to the deferral debt
b. The borrowed money is used to pay down its debt
c. None of the above
d. I don’t know/ I am not sure

11. What is the total federal debt for 2015?
a. $ 20.7 trillion
b. $ 1o.5 trillion
c. $ 16.5 trillion
d. I don’t know/ I am not sure

General Interest Questionnaire

1. Do you think the information was presented in an orderly manner?
   a. Yes
   b. No
   c. I don’t know/I am not sure
2. Was it easy for you to follow the information flow?
   a. Yes
   b. No
   c. I don’t know/I am not sure
3. How interesting did you find the information?
   a. Very interesting

b. Somehow interesting
c. Interesting
d. I am indifferent
e. Boring
f. Rather Boring
g. Very Boring

4. Would you be interested in receiving additional information on the topic?
    a. Yes
    b. No
    c. I don't know/I am not sure
5. All in all, how did you like the way that the information was presented?
    a. Liked it very much
    b. Somehow liked it
    c. Liked it
    d. I am indifferent
    e. Dislike it
    f. Somehow disliked it
    g. Completely disliked it
6. What did you like about the way in which the information was presented?
7. What did you dislike about the way in which the information was presented?
8. What would you improve in the way that the information was presented?

Appendix C: Treatments for Candidate Experiment

Questionnaire Democrats

1. Conceptually, what kind of taxation do the Democrats support?
    a. Flat taxation
    b. Progressive taxation
    c. None of the above
2. What kind of healthcare policies do the Democrats usually support?
    a. They support private companies; because they can provide healthcare services more efficiently than government-run programs
    b. They support universal healthcare and government involvement in healthcare
    c. None of the above
    d. I don't know/ I am not sure
3. When it comes to the role of government Democrats usually support
    a. Small government in terms of number of administration and government responsibilities
    b. Big government in terms of government responsibilities in society
    c. None of the above
    d. I don't know/ I am not sure
4. Democrats usually attach greater importance to
    a. Equality and social responsibility

b. Individual freedoms, rights and responsibilities
c. None of the above
d. I don't know/ I am not sure

5. What is the symbol of the Democrats?
   a. A donkey
   b. An elephant
   c. A mule
   d. I don't know/ I am not sure
6. What does the term "Blue state" mean?
   a. A state in which Republicans traditionally dominate
   b. A state in which Democrats traditionally dominate
   c. None of the above
   d. I don't know/ I am not sure
7. Who is the current leader of the Democratic party in the House of Representatives (Minority Leader)?
   a. Steny Hoyer
   b. Nancy Pelosi
   c. Harry Reid
   d. I don't/ I am not sure
8. Which of the Presidents listed below were members of the Democratic party? (Check all that apply)
   a. Jimmy Carter
   b. Ronald Reagan
   c. Richard Nixon
   d. John F. Kennedy
   e. Teddy Roosevelt
   f. Franklin Roosevelt

After-treatment (Democrats)

1. How did you like the way that the information about the candidate was presented?
   7-point scale
2. How appealing did you find the candidate?
   7-point scale
3. Which of the bellow listed are among the candidate's main priorities?
   a. Every state citizen's economic stability
   b. Discouraging of government's bureaucracy
   c. Fighting corruption
4. Which of the bellow listed issues did John Preston previously support?
   a. Helped to approve lower taxes for low and middle-income citizens
   b. Programs for better treatment and veteran's support
   c. None of the above
5. What does the candidate support? (Check all that apply)
   a. Affordable childcare, paid family leave
   b. State's business climate that promotes growth

c. Access to reproductive healthcare
d. Ownership of the state's land by the local people
e. Governmental transparency and accountability
f. College affordability and reducing of student loan debts

6. Which of the following groups' interests is the candidate advocating for?
   a. Socially vulnerable groups like seniors and students
   b. Small business owners' interests
   c. All of the above listed
7. Based on the information above and your knowledge of the candidate, do you see yourself voting for John Preston?
   a. Yes
   b. No
   c. I don't know/ Don't want to answer

Pre-Treatment Republicans

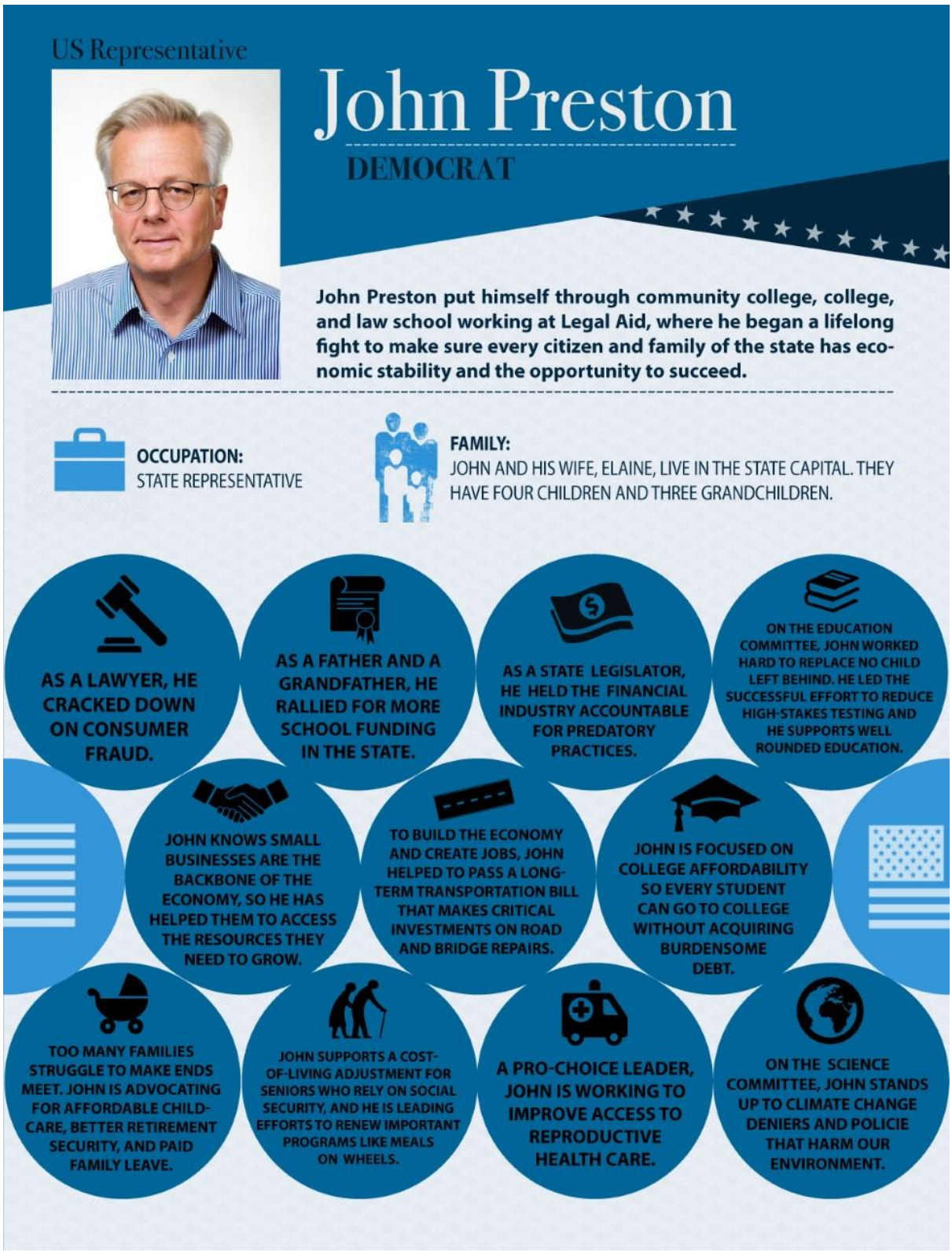
1. Conceptually, what kind of taxation do the Republicans support?
   a. Flat taxation
   b. Progressive taxation
   c. None of the above
   d. I don't know/ I am not sure
2. What kind of healthcare policies do the Republicans usually support?
   a. They support private companies; because they can provide healthcare services more efficiently than government-run programs
   b. They support universal healthcare and government involvement in healthcare
   c. None of the above
   d. I don't know/ I am not sure
3. When it comes to the role of government Republicans usually support
   a. Small government in terms of number of administration and government responsibilities
   b. Big government in terms of government responsibilities in society
   c. None of the above
   d. I don't know/ I am not sure
4. Republicans usually attach greater importance to
   a. Equality and social responsibility
   b. Individual freedoms, rights and responsibilities
   c. None of the above
   d. I don't know/ I am not sure
5. What is the symbol of the Republicans?
   a. A donkey
   b. An elephant
   c. A mule
   d. I don't know/ I am not sure
6. What does the term *Red state* mean?
   a. A state in which Republicans traditionally dominate
   b. A state in which Democrats traditionally dominate
   c. None of the above
   d. I don't know/ I am not sure

7. Who is the current leader of the Republican Party in the House of Representatives (Majority Leader)?
    a. Mitch McConnell
    b. Kevin McCarthy
    c. Steve Scalise
    d. I don't/ I am not sure
8. Which of the Presidents listed below were members of the Republican party? (Check all that apply)
    a. Jimmy Carter
    b. Ronald Reagan
    c. Richard Nixon
    d. John F. Kennedy
    e. Teddy Roosevelt
    f. Franklin Roosevelt

After-treatment Republican

1. How did you like the way that the information about the candidate was presented?
   7-point scale
2. How appealing did you find the information about the candidate?
   7-point scale
3. Which of the bellow listed are among the candidate's main priorities?
    a. Every state citizen's economic stability
    b. Discouraging of government's bureaucracy
    c. Fighting corruption
4. Which of the bellow listed issues did John Preston previously support?
    a. Helped to approve lower taxes for low and middle-income citizens
    b. Programs for better treatment and veteran's support
    c. None of the above
5. All in all, what does the candidate support? (Check all that apply)
    a. Affordable childcare, paid family leave
    b. State's business climate that promotes growth
    c. Access to reproductive healthcare
    d. Ownership of the state's land by the local people
    e. Governmental transparency and accountability
    f. College affordability and reducing of student loan debts
6. Which of the following groups' interests is the candidate advocating for?
    a. Socially vulnerable groups like seniors and students
    b. Small business owners' interests
    c. All of the above listed
7. John Preston is currently running for re-election. Based on the information above and your knowledge of the candidate, would you vote for him?
    a. Yes
    b. No
    c. I don't know/ Don't want to answer

Treatments Democrats



US Representative

John Preston

Democrat

John Preston put himself through community college, college, and law school working at Legal Aid, where he began a lifelong fight to make sure every citizen and family of the state has economic stability and the opportunity to succeed.

Occupation: State Representative
Family: John and his wife, Elaine, live in the state capital. They have four children and three grandchildren.

- As a lawyer, he cracked down on consumer fraud.
- As a father and a grandfather, he rallied for more school funding in the state.
- And, as a state legislator, he held the financial industry accountable for predatory practices.
- On the Education Committee, John worked hard to replace No Child Left Behind. He led the successful effort to reduce high-stakes testing and he supports well rounded education.
- John knows small businesses are the backbone of the economy, so he has helped them to access the resources they need to grow.
- To build the economy and create jobs, John helped to pass a long-term transportation bill that makes critical investments on road and bridge repairs.
- John is focused on college affordability so every student can go to college without acquiring burdensome debt.
- Too many families struggle to make ends meet. John is advocating for affordable childcare, better retirement security, and paid family leave.
- John supports a cost-of-living adjustment for seniors who rely on Social Security, and he is leading efforts to renew important programs like Meals on Wheels.
- A pro-choice leader, John is working to improve access to reproductive health care.
- On the Science Committee, John stands up to climate change deniers and policies that harm our environment.

Treatments Republicans

US Representative

John Preston

Republican

John Preston put himself through college, becoming a Marine, a cancer doctor, a business owner and a state legislator. He believes that legislators should focus on the people. The growth of government bureaucracy, which slows citizens down by playing with their livelihoods, must be discouraged. Special interests must be tamed, and corruption must stop.

Occupation: State Representative; Businessman
Family: John and his wife, Elaine, live in the state capital. They have four children and three grandchildren.

- As a member of the Finance Committee, John helped to approve lower taxes for low and middle-income citizens.
- As a veteran, he advocated for better treatment and support for veterans.
- As a father and grandfather, John supported families by advocating for the creation of more options and affordable choices for childcare.
- John knows it is important to ensure that the state's business climate promotes growth. He is advocating for more high-wage jobs and rising incomes, especially for those in rural areas.
- He is working towards cutting costs of government and establishing true transparency and accountability.
- John defends the 2nd Amendment.
- He is actively fighting to end crony capitalism by eliminating giveaways and perks for the well-connected.
- John is advocating education reform so our schools will be a role model for the nation.
- He is supporting families by creating more options and affordable choices for childcare.
- One of his main goals is rebuilding our crumbling transportation infrastructure resulting in more jobs and ease of travel around our state.
- John is working towards the goal of ownership of the state's land by our people.

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