

Rhetorical Appeals in Design for Social Change

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Dedication

Dedico esta tesis doctoral a mi esposa, Ángela, y mi hija, Elena.

Las amo hasta más allá del cielo

Abstract

Design enables us to adapt the built environment to people's needs and to empower people interacting in the environment. Yet, design knowledge about how to design products effectively is limited. Neither traditional intuitive design methods centered on visual language nor human-centered design methods centered on cognition adequately address the needs of people of different cultures in different contexts. A rhetorical approach to design can provide methods and principles to understand people's culture and context. In this study, the researcher sought to map and understand the rhetorical appeals (i.e., logos, pathos, ethos) in design for social change.

This research is a pragmatic primarily qualitative study developed in three stages. (1) The researcher examined design products for social change (i.e., animated viral videos) with rhetorical appeals analysis and expert interviews. (2) He led the design of a product (i.e., a mobile web application for Latino parents about childhood obesity prevention called *Lifecast*) and conducted an auto-observation of his behavior as the designer. (3) He evaluated the design product with design experts and in the real context using heuristics, participant observation, and in-depth interviews.

The researcher found that strength of the three rhetorical appeals generates a wide reception. He concluded that an effective strategy of rhetorical appeals should be carefully planned and continually reviewed. In the evaluation of the design product, he

found that parents and their children were motivated to use the design product and exhibited positive change in their knowledge, attitudes, and behavior.

The researcher identified salient indices and strategies that constitute an inventory to organize the rhetorical appeal concepts in graphic design, that thus far are imprecise theoretical concepts. Also, he proposed rules of thumb about the rhetorical appeals in design for social change. Future research should focus on not only visual and textual elements, but also on design concept, design format, and interactivity elements.

Finally, the researcher examined design research methods and discussed issues of design practice in research, research frames, and research paradigms. Based on the concepts mapped in this dissertation, future research on rhetorical appeals in design for social change should include experimental methods.

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1. Introduction

This dissertation is an examination of rhetorical elements of graphic design products that are created for social change; specifically, the products include four animated viral videos on social issues and a mobile web application for obesity prevention. The particular focus is on rhetorical appeals, which include three modes of persuasion: logos is an appeal to reason, pathos to emotion, and ethos to character and credibility. The central area of study consists of understanding the rhetorical appeals in graphic design products that positively change people's knowledge, attitudes, and behaviors.

1.1. Background

Even though design integrates knowledge from well-established fields such as psychology, sociology, art, and neurosciences, design researchers are still crafting foundations and methods for knowledge production in the field (Sevaldson, 2010). Design practitioners, in terms of the visual language, learn principles of order and elemental perception to create visual compositions for graphic and industrial products. However, design knowledge that only helps to solve composition problems is insufficient. The field is evolving and today design has expanded its focus from graphic

symbols and industrial products to human interaction and environmental systems (Buchanan, 2001). Design knowledge is needed to understand “what makes a product *useful, usable, and desirable*” (Buchanan, p. 13). Design practitioners need methods, principles, and theories that not only help them manipulate the visual language, but also inform them how design products perform when people interact with them.

To cope with this challenge, the design community has sought to integrate human-centered methods, which aim to satisfy human needs in terms of usability and understanding (Norman, 1988). In graphic design, educators and practitioners have embraced these methods and proposed alternative names for the field, such as information design, interaction design, or visual communication design. These mutations reveal the need to go beyond subjective expression, which has been central in design education. However, human-centered design methods overlook aesthetics and concentrate on utilitarian and practical issues such as ergonomics, practical communication, and usability.

The theory of rhetoric in design is an alternative that softens the dichotomy between expression and practical functions, and merges multiple demands of contemporary design from aesthetics to usability. It recognizes design products as persuasive systems and acknowledges the critical place of the audience in the context of use, which is a rhetorical situation. Contemporary design scholars have agreed about the potential of a rhetorical approach in design (Bonsiepe, 2000; Buchanan, 1985, 1995; Jenkins, 2009; Tyler, 1992). However, design knowledge in rhetoric is limited to figures

and tropes to organize grammatical problems in graphic products (e.g., McQuarrie & Philips, 2007). Further development of the theory of rhetoric in design will provide principles to increase the designer's ability to generate a more intimate connection between people and the design products in their environment.

In rhetorical terms, the design product is both the speaker and the speech that has a persuasive goal. Since the design product has an independent-from-the-designer role in the 'delivery of the speech', the design product as a rhetorical system becomes a core of study. The rhetorical system is created employing three appeals or modes of persuasion: logos, pathos, and ethos. Logos is an appeal to reason, pathos is an appeal to emotion, and ethos is an appeal to character and credibility. The rhetorical appeals are a fertile and unexplored area for design research to understand how people use design products and how design products influence people.

In rhetoric, persuasive speeches result from the understanding of the audience within the rhetorical situation. Likewise, effective design products result from a clear understanding of their intended context of use. The preoccupation for the people in a rhetorical approach for design implies cognitive and cultural aspects of those who will interact with the products. Further, design products are persuasive systems that help people perform intelligible actions in the environment (Buchanan, 1985). The designer creates them to assist people to interact within context explaining, suggesting, or influencing possible behaviors.

When the design problem involves social change, a rhetorical approach to design

has a particular potential. Rhetorical methods help designers, who are creating design products for social change, to understand socio-cultural contexts and to extend the persuasive toolset. Social design or design for social change has been gaining present recognition. Papanek (1984) first championed it and others have developed models and frameworks (e.g., Bonsiepe, 1985; Frascara, 1997; Margolin & Margolin, 2002; Nieuwma, 2004). Nonetheless, design knowledge, as in many design research areas, is lacking.

A critical challenge in designing for social change arises when designing for people with limited functional literacy. Functional literacy, a human characteristic that has received little attention in design research, is the ability to interact in the society and deal with the increasing complex flow of everyday information (Ntiri, 2009). Functional literacy or 'literacies' are determined for contextual and cultural factors. For example, in the United States, functional health literacy is the ability to comprehend health information and self-care, according to Western worldviews of health. People with limited functional literacy have the same cognitive processes, but their cultural and contextual characteristics heighten the design challenge.

How many people in the world are functionally illiterate? We can begin with how many are traditionally illiterate. According to the United Nations Educational, Scientific, and Cultural Organization – UNESCO (2005), one-fifth of world's population (including 2% in the United States) is not able to read or write a language. However, the percentage of the functional illiterate population is larger. According to the National Center for

Education Statistics (n.d.), that measures functional literacy in terms of skills, in the United States 14% of people are below basic prose skills, 12% are below basic document skills, and 22% are below basic quantitative skills. There is not available a statistic for functional literacy in the world, but the statistic in the United States allows deducting that the population of functionally illiterate adults is much larger. People with limited functional literacy are often the main target of social design efforts, such as those regarding hunger, water access, disease prevention, or democratic participation. Therefore, social designers that target unprivileged and underrepresented populations need to understand the level of functional literacy of their audiences.

In this dissertation, a design project is embedded in the design research in the area of disease prevention, particularly childhood obesity. Obesity is a chronic condition with growing prevalence in the world and a major factor that causes chronic disease conditions. In the United States, one out of five children from ages 6 to 11 is obese (Center of Disease Control and Prevention, 2013), with higher prevalence among low-income and minority families (Ogden & Carroll, 2010). Moreover, Latino children double the rate of obesity of non-Latino children, and their parents are likely to have limited functional health literacy (Huizinga et al., 2008). When parents have limited ability to read food labels, understand growth charts, or understand recommendations in portion sizes, they are ill equipped to effectively influence their children's diet, weight, and health.

1.2. Statement of the problem

Design, like formal education, is a valid strategy to help people achieve goals and generate social change. Formal education focuses on improving people's abilities to comprehend verbal and visual information and successfully interact within their context. Design is an alternative strategy to improve people's abilities not only with design products that have educative goals, but also with design products that are sensible to people's abilities and needs. Yet, there is limited design knowledge that provides explicit understanding of how to design products for social change. Research is needed to understand how to design products that take into account limitations, needs, and desires of people to help them achieve goals and generate social change. In this dissertation, the researcher investigates the rhetorical appeals in graphic design products that positively change knowledge, attitudes, and behaviors of people.

Designers have primarily relied on intuition and elemental principles of the visual language to create design products. The focus on visual order and interpretation of signs is known as the grammatical approach, which has been criticized because it does not account for people's needs (e.g., Buchanan, 1985; Tyler, 1992). In a cognitive approach, designers may also use principles of perception and human-centered design methods to account for universal meaning and usability. However, designing for efficient cognition does not always solve the needs of people with different cultural characteristics or levels of functional literacy. As a result, design products exclude people in society. The general aim of this research is to generate design knowledge and principles that help to create

more “useful, usable, and desirable” (Buchanan, 2001, p. 13) design products for social change.

A trend in graphic design is to value simplicity to achieve comprehension of content; it is the core of design products such as information graphics and visualizations. Furthermore, the focus in the branch of interactive design is on interfaces to create usable products, which also leads to valuing simplicity. However, simplicity is insufficient when the design goals are beyond information processing or usability. Knowledge, attitudes, behavior, or social change goals require additional design strategies to create successful engagement and interactions. This research, from a rhetorical approach, is a study of design strategies that not only include simple and rational arguments but also the emotions of people and the credibility of information and experiences.

1.3. Overview of the study

The purpose of this research is to understand the rhetorical appeals in graphic design products that positively change knowledge, attitudes, and behaviors of people. The researcher aims to map and define this area of design research within three stages.

Stage one: The purpose of this stage is to analyze the rhetorical appeals in existing successful design products that positively change knowledge, attitudes, and behaviors of the audience. The selected products include four animated viral videos about social issues, such as awareness on climate change and the defense of Internet rights. Research methods include a rhetorical appeals analysis and expert interviews.

Stage two: This stage consists of the researcher designing a product and observing his decisions regarding rhetorical appeals for the project. The project included making a mobile web application for Latino parents about preventing childhood obesity. The application has three modes of use, each mode emphasizing one type of rhetorical appeal. The researcher-designer made observations on his behavior in designing the product, especially looking at how design decisions are made regarding the configuration of rhetorical appeals. The research method was autoethnography.

Stage three: The purpose of this stage is to examine the rhetorical appeals in a design product that changes knowledge, attitudes, and behaviors of people — specifically, a mobile web application for Latino parents about obesity prevention in their children. This stage included design-experts evaluation and real-context evaluation using heuristic evaluation, participant observation, and in-depth interviews.

Research objectives and questions

See Table 1 for a paired listing of research objectives and related questions.

Table 1.

Research Objectives and Questions

	Research objectives	Research questions
1	To analyze the rhetorical appeals in designed products for social change (i.e., animated viral videos).	How are rhetorical appeals configured in a successful category of design products for social change (i.e., animated viral videos)?
2	To design a product for social change (i.e., mobile web application) that has three modes of use with different configuration of rhetorical appeals.	How does the researcher-designer make decisions about rhetorical appeals in the design process?
3	To evaluate the efficacy of a design product (i.e., mobile web application) to positively change knowledge, attitudes, and behaviors.	What is the efficacy of a design product (i.e., mobile web application) to motivate use and positively change knowledge, attitudes, and behaviors?
4	To assess the rhetorical appeals in a design product for social change (i.e., mobile web application).	How are the rhetorical appeals configured in a design product for social change (i.e., mobile web application)?
5	To identify rules of thumb or design principles related to rhetorical appeals in design for social change.	What are some design principles related to rhetorical appeals in design for social change?
6	To explore design research methods and contribute to the current epistemological debate in design research.	What are the appropriate methods to do design research?

Methods

This research is pragmatic and primarily uses qualitative methods. Since the researcher aims to map and define this area of design research, he uses varied methodological approaches and comparison of findings. The research consisted of three stages: (1) the analysis of rhetorical appeals in graphic design products for social change (i.e., four viral animated videos), (2) the design of a graphic product for social change (i.e., a mobile web application about childhood obesity prevention for Latino parents called *Lifecast*) and the auto-observation of the researcher-designer's behavior incorporating rhetorical appeals in a design process, and (3) the evaluation of a graphic design product for social change (i.e., *Lifecast*) and the analysis of its rhetorical appeals.

In the first stage, the researcher analyzed graphic design products using expert interviewing and rhetorical appeals analysis. Four viral animated videos were included on topics of climate change, Internet rights, and capitalism. Four experts were interviewed: two producers of the videos, a chief director of an institution that produced one of the videos, and one researcher on climate change communication. The rhetorical appeals analysis is a categorization of salient indices that aim to appeal to logos, pathos, and ethos. The goal was to understand how successful design products effectively used configurations of rhetorical appeals.

The second stage was the design of a product for social change and the auto-observation of the researcher-designer behavior related to the use of rhetorical appeals in the design process. The design product is a mobile web application for childhood obesity

prevention called *Lifecast*. It aims to increase health knowledge and change health attitudes in Latino parents in Minnesota. *Lifecast* has three rhetorical modes or interactive styles, each with a specific configuration of rhetorical appeals. The modes are infographic, comic, and realistic. Each mode has a base of rational appeals (logos), and varies in the prevalence of the other two appeals (pathos and ethos). Infographic mode is intended to have simplicity and has a reduced number of emotional (pathos) and credibility (ethos) appeal indices. Comic mode has an increased number of emotional (pathos) appeal indices. And realistic mode has an increased number of credibility (ethos) appeal indices. The design project included two usability tests: one with a low-fidelity paper prototype and the other with a high-fidelity digital prototype. The findings from these tests informed the design decisions but they did not constitute the design research activity. Rather, the research component was a continuous reflection about how design decisions were made. The goal was to understand how the rhetorical appeals are applied in the design product.

The third and last stage was the evaluation of a design product for social change (i.e., *Lifecast*) and the analysis of its rhetorical appeals. This stage consisted of a design-experts evaluation and a real-context evaluation. In the design-experts evaluation, three experts heuristically assessed how the rhetorical appeals were used in each rhetorical mode of *Lifecast*. In the real-context evaluation, three groups of Latino parents used the application (three parents for each rhetorical mode, for a total of nine parents) and the researcher interviewed them in depth about how each mode changed their knowledge and

attitudes. The goals were to evaluate the efficacy of and to understand the configuration of rhetorical appeals in a design product that changes knowledge, attitudes, and behaviors in low-income people.

1.4. Definition of key terms

Design

According to Buchanan “design is the human power of conceiving, planning, and making products that serve human beings in the accomplishment of their individual and collective purposes” (Buchanan, 2001, p. 9). He explained that the design process generates design products that are not always physical objects. He also argued that, since late twentieth century, design products shifted from symbols (graphic design) and things (industrial design) to forms of actions that help people interact (interaction design) and to systems that organize systems (environmental or systems design). In other words, design products expanded from information and physical configuration to experiences and services that assist human actions in the environment. In this dissertation, the design product is understood as the outcome of the design process.

Design format

Design format refers to the medium in which a design product is delivered to people. In graphic design, traditional formats utilize printed media; for example, posters, books, or signs. Digital media has popularized new design formats that include, among others, online video, mobile web, videogames, and digital books.

Design concept

Design concept refers to the central idea, meaning, and strategy of a design product. Design concepts depend on the design format. For example, in digital media the core mechanics of the interactivity is part of the design concept.

Rhetorical appeals

Rhetorical appeals are the components of the speech that work as the modes of persuasion. In classic rhetoric, the three appeals are logos, pathos, and ethos. Appeals to logos provide the truth or seem to provide the truth with rational argumentation. Appeals to pathos lead the audience to feel emotions. And appeals to ethos are the credibility in the delivery of the speech (not the reputation of the speaker). In design products, logos is the rational component, pathos the emotional component, and ethos the credibility component. A rhetorical approach to design allows identifying design products as speeches that assist people to perform everyday actions. Any design product delivers all rhetorical appeals; however, some have different configurations with a logos argument, and more or less presence of pathos and ethos indices. For example, a statistical diagram has a solid logos argument, but a reduced presence of pathos and ethos indices.

Comparably, a brand has a simple logos argument and an augmented ethos index.

Rhetorical situation

The rhetorical situation is the context that determines the speech in terms of time, place, exigency (goal of the speaker), and audience. A good speaker understands the elements of the rhetorical situation to deliver a persuasive speech.

Social design or design for social change

Social design or design for social change is the orientation of design activities towards genuine human needs (Papanek, 1984). This approach to design encompasses diverse views from radical ones, such as anti-consumerism anti-market design, to moderate ones, such as contextual design or design for the base of the pyramid. In this dissertation, design for social change refers to design activities and products that aim to positive change knowledge, attitudes, and/or behaviors of people.

Functional literacy

Even though the most known definition of literacy is the ability to read and write a language, the concept has been debated in the last decades. Freire (1973), for example, explained that literate individuals are independent and able to achieve social well being. Recently, the concept of functional literacy has been used to describe abilities related to socio-cultural context. Ntiri (2009) defined functional literacy as the ability of individuals to interact in the society and deal with the increasing complexity of their socio-cultural context. She explained that individuals with limited functional literacy have problems accessing the everyday flow of information. For instance, some do not fully comprehend nutrition labels in the grocery store, some are not able to hold data entry jobs, or some do not know how to vote in election of public officials.

1.5. Organization of this dissertation

This dissertation has five chapters. In this first chapter, the researcher has described the gap of knowledge in design research. In the second chapter, the researcher will review the related literature in design and associated fields. Specifically, he will review theories of rhetoric and design for social change, and he will propose a theoretical framework. He also will review literature in design research methodology. In the third chapter, the researcher will describe the methods used in the three stages of the dissertation and discusses methodological issues in design research. In the fourth chapter, the researcher will report the findings of each stage. In the final chapter, the researcher will discuss and interpret the findings, present conclusions related to the research questions and make recommendations for further design research in the area.

The author of this dissertation uses the word researcher to refer to himself in the majority of the sections. He uses researcher-designer in sections that describe activities in which he also acted as a designer.

The researcher has published manuscripts throughout the dissertation research process and portions of them have been edited to form part of this doctoral dissertation. The publications include the following.

Chu, S., & Mejía, G. M. (2013, July). *Application of rhetorical appeals in interactive design for health*. Paper presented at the meeting of the Fifteenth International Conference on Human-Computer Interaction (HCI), Las Vegas, NE.

Mejía, G. M., & Longo, B. (2012, August). *Web-based visual communication for*

social criticism: Powerful design. Paper distributed at the meeting of the Second International Sociological Association (ISA) Forum of Sociology: Social Justice and Democratization, Buenos Aires, Argentina.

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2. Literature review

This chapter is the review of literature related to the area of research of this dissertation. In the first chapter the researcher stated that the problem of this dissertation is to investigate how design products positively change knowledge, attitudes, and behaviors of people and what is the role of the rhetorical appeals of the products in this process. This problem is seen from a critical position towards the contemporary design focus on cognition, usability, and simplicity. Designing for efficient cognition using simplicity does not always solve the needs of people with different cultural characteristics or levels of functional literacy.

This statement of the problem can be divided into two major aspects: the design product characteristics (rhetorical appeals) and the type/class of design problems (social change). The researcher reviewed literature in theories of these two aspects. The first section is a review of the theory of rhetoric in design, including a segment about the rhetorical appeals. The second section is a review of design approaches related to social change. It includes a subsection about functional literacy as a core issue in the audience for this type of problems.

This chapter also includes a theoretical framework for design research, which is a model that connects the theories of rhetoric, functional literacy, and design. The model aims to serve design research beyond this dissertation. However, the model is also adapted to organize concepts and variables that are investigated in this dissertation.

Finally, since previous research related to the problem is limited and design research methods are not well established, the researcher reviewed literature about design research methodology. The goal of this last section is to provide a more solid ground for decisions regarding the design research methods of this dissertation.

2.1. Theory of rhetoric in design

The subsections below contain aspects of the theory of rhetoric in design. First, the rhetorical approach in the broad field of design is discussed. Second, the use of rhetorical methods in graphic design is presented. Third, core ideas of classic rhetoric that have been used to describe design are explained: branches, appeals, canons, and uses. Fourth, the rhetorical appeals in classic rhetoric and in design are explained. Also, previous design research about rhetorical analysis using the appeals is reviewed. Last, a brief reflection of the theoretical contributions of the theory of rhetoric to design is presented.

Rhetorical approach to design

Rhetoric is predominantly known as the art of persuasive speech, one of the three arts of discourse besides grammar and dialectic. Aristotle's *On Rhetoric* is considered the first seminal work in rhetoric. It is a collection of three books that was written in the fourth century B.C.E. in Greece. Rhetoric was understood as an art for public speaking in

political debates, courts, and events in a context of Greece's emerging democracy.

Nowadays, rhetorical methods have been studied in different fields related to communication. Buchanan (1995) argued that Aristotle considered rhetoric as an art of arguments for all made things, extending the concept beyond words. Buchanan suggested that rhetoric was one of the first design activities.

The relationship between design and rhetoric has been uneven. Buchanan (1995) explained that design and rhetoric had been seen as separate field for centuries. First, after Aristotle, rhetoric was used mainly in speech, which created a separation between words and things. And later, in the Renaissance, a separation between fine and practical arts excluded design from the liberal arts, which condemned it to a "servile activity" (p. 35). However, design has become a field that owes its foundations to rhetorical ideas. For Schriver (1997), designers had started to advocate for a rhetorical approach as early as the Russian constructivism or the German Bauhaus in the 1910s when they drew attention to the needs of the audience and the characteristics of the context in the design process. According to Buchanan (1995), the redirection of design towards rhetoric began with Hebert Simon who in his book *The Sciences of Artificial* (Simon, 1969), framed design disciplines with elements of rhetoric. Buchanan explained that Simon differentiated between the prescriptive character of design and the descriptive character of sciences. Prescription coincides with the rhetorical study of how things may be.

Buchanan's essays are an effort to define epistemological foundations in the field of design from the theory of rhetoric. He first asserted that not only graphic design but

also the large field of design should build a theory of rhetoric that will provide intelligible products that can be assessed by the general public and will guide products' integration in social activities (Buchanan, 1985). He later claimed that design is a "new liberal art of technological culture" that evolved from rhetoric (Buchanan, 1995). For him the theory of rhetoric in design integrates art and science, and theory and practice. He also asserted that since design knowledge is indeterminate and potentially universal, the subject matter becomes the process of creation of arguments/products (i.e., rhetoric).

In an operational level, the theory of rhetoric also allows recognizing design objects as persuasive systems that can be produced and analyzed using the rhetorical components. Design researchers generally agree that early expressive and grammatical approaches are insufficient for design and consider the rhetorical approach potentially valuable (e.g., Bonsiepe, 2000; Buchanan, 1985, 1995; Jenkins, 2009; Joost & Scheuermann, 2006; Tyler, 1992).

Whereas a grammatical approach centers the attention on visual compositional elements of the design products, a rhetorical approach expands the design problem by including the audience and locating the product within a context. Buchanan (1985) clarified this issue; he distinguished communication in design products from grammatical and rhetorical approaches. In the former, information and emotion are passed to the audience. In the latter, arguments intend to modify beliefs in the audience. Buchanan argued that design reinterprets rhetoric canons beyond style, affecting design products and processes. Later, Tyler (1992) extended Buchanan's differentiation by analyzing the

relationship between the audience and graphic design. She distinguished four views: (1) formal aesthetic expression view in which audience is spectator; (2) grammatical view in which audience is passive reader; (3) semiotics view in which audience is active reader; and (4) rhetorical view in which existing beliefs are used to induce new ones. Although Tyler intended to encourage the use of the fourth, rhetorical, view, her model is problematic because an essential canon or element of rhetoric is aesthetic expression. Thus, the first view appears to belong to the fourth.

The idea of understanding these approaches as exclusive philosophies is contestable. Recently, Van der Waarde (2010) used rhetoric to analyze a category of design products: visual medicine directions. He concluded that rhetoric is insufficient to cover all issues involved in the design problem. He suggested that grammar-logic and dialectic need to be added for a more comprehensive analysis of design products. His suggestion implies that a theory of discourse in design that includes grammar, rhetoric, and dialectic needs further development.

Up to here, the discussion has centered on how classic rhetorical theory has been incorporated in design. But Kaufer and Butler (1996) connected the concepts of rhetoric and design in a different way. They inquired about how classic rhetoric, as verbal production of speech, is a type of design. They argued that rhetoric should come back from an analytical knowledge to a productive knowledge. They positioned rhetoric as a design art at the same status of other design arts such as architecture, engineering, or graphic design.

Rhetorical approach to graphic design

Before the understanding of rhetoric in design beyond the grammatical approach, graphic designers had analyzed graphic products using semiotics and stylistic elements of rhetoric. According to Poynor (1999), in the 1950s Tomás Maldonado and Gui Bonsiepe in the Ulm School of Design looked for semiotic analysis using modern rhetoric to study graphic objects. Bonsiepe (1965) contended that only stylistics in the rhetorical process is useful for persuasion analysis in advertising design. He organized stylistic elements of rhetoric (i.e., rhetorical figures) into a semiotic structure with syntactic, semantic, and pragmatic categories to analyze visual advertisements. Krampen (1968), discussing theories that support graphic symbol design, contended that the use of rhetorical figures is only recommended for sophisticated and highly educated audiences because imaginative expression may confuse low-literate audiences.

More recent studies show a similar use of rhetorical devices but still from a grammatical approach. Ehses (1984) presented a case study of graphic design in which rhetorical figures provided a source for visual concept development in order to create meanings from combination of signs. Other studies have also shown a similar application of rhetorical figures for visual persuasion (e.g., Joost & Scheuermann, 2006; McQuarrie & Philips, 2007). Buchanan (1985) argued that these kinds of contributions have value but they are limited to a semiotic analysis. As noted above, these types of studies in graphic design does not exploit all the methods of rhetoric to produce knowledge.

Other recent studies in graphic design have also discussed the role of rhetoric.

Bonsiepe (2000) proposed a transformation from graphic design to information design, in which rhetoric would have a primary role. The application of rhetoric, he said, would help people to cope with the complexity of contemporary information. He affirmed that digital media has brought up the need to study cognition and the rhetoric of multiple audiovisual formats. In this, aesthetics should be a constitutive factor and not simply an accessory of usability, whose focus on cognitive speed has proved to be insufficient. He argued that “audio-visual rhetoric” provides a ground theory to expand the design field. Designers, then, would be able to successfully present knowledge, which involves transformation from data to information and from information to knowledge.

Now agreeing with Buchanan (1985), Bonsiepe (2000) differentiated between grammar and rhetoric. He suggested that in the grammatical approach, the speech is created following language rules, whereas in the rhetorical approach, the speech creation is concerned with embellishment and reduction of boredom. However, Bonsiepe’s understanding of rhetoric seems to be more simplistic because he gives premier consideration to aesthetics without discussing other rhetorical methods. A study by Joost and Scheuermann (2006) seem to borrow this focus on aesthetics. They explained that visual rhetoric techniques “aim for efficient and aesthetical attractive communication, avoiding boredom (*teadium*) and grabbing the audience’s attention (*attentum parare*)” (p. 1). Their contribution is limited to a list of rhetorical figures that could be applied in the design of audiovisual media and motion graphics.

Jenkins (2009) also explored the application of rhetoric in design problem

solving. He contended that rhetoric is a toolkit of information design to cope with today's information complexity. His essay particularly reflected about information provided to managers for organizational decision-making and proposed the change from an analytical to a rhetorical approach of information presentation. This rhetorical toolkit improves user thinking processes and experience by enriching the traditional objective/quantitative information with subjective/qualitative information, which gives broader argumentation for decisions. Although Jenkins set up rhetoric as a toolkit, he suggested a larger role for rhetoric when he stated, "Design is the modern incarnation of rhetoric" (p. 196).

From a technical communication perspective, Kostelnick and Hassett (2003) argued that designers of information apply rhetorical judgment to select and adapt visual conventions. Conventions, for them, are social abstractions that appear, transform, and disappear according to rhetorical situations in history and culture within discourse communities. They observed that designers' rhetorical decisions define structure, credibility, and tone of the information. They also posited that appeals to pathos and ethos are tools to break conventions, which may confuse users. The value of Kostelnick and Hassett's framework is their aim for the stability of visual language and their insightful connections to cultural aspects of design. However, they assume a narrow technical view of information design that overvalues appeals to reason.

Rhetorical appeals

According to Aristotle, there are artistic and non-artistic means of persuasion

(*pisteis*). The artistic means are provided through speech and the non-artistic means are not (e.g., direct evidence that is not part of the persuasive speech, but that is available to judges, such as from witnesses and documents). The speaker only has control over the artistic means of persuasion. There are three modes or forms of *pisteis*, called rhetorical appeals: the truth or apparent truth of the arguments (*logos*), leading the audience to feel emotions (*pathos*), and the credibility of the spoken word (*ethos*) (Aristotle & Kennedy, 1991). The following paragraphs briefly present Aristotle's definitions of the rhetorical appeals (Aristotle & Kennedy, 1991).

Aristotle contended that *logos* is about providing logical reasons using enthymemes or paradigms. Kennedy, a translator of Aristotle, explained that enthymemes are syllogisms that are incomplete and take the form of giving a reason and then a conclusion; and paradigms are inductions that take the form of stating a particular observation, leaving the conclusion unstated.

Aristotle explained that *pathos* refers to emotions of pleasure or pain (positive or negative) that affect the judgment of the audience. These are temporary states of the mind evoked in the speech. He classified them in opposite pairs: anger/calmness, friendliness/hostility, fear/confidence, shame/shamelessness, kindness/unkindness, pity/indignation, and envy/emulation. Speakers try to arouse positive or negative emotions in the audience, depending on the strategy. For example, friendliness is sought if the goal is align the audience with the speaker or pointing out shame on an opponent may be wanted, so the audience blames him or her.

Aristotle stated that ethos is the construction of a view of the kind of person that the speaker is, which then prepares the audience to make a judgment. He explained three reasons of ethos persuasion: wisdom (practical sense), virtue (ability to say thoughts), and good will (prudence and fair-mindedness). Kennedy interpreted that ethos “refers to the trustworthy character of a speaker as artistically created in a speech” (Aristotle & Kennedy, 1991, p. 148). Kennedy also indicated that Aristotle, presumably, did not include the credibility of the speaker based on his or her reputation because these factors are inartistic. Ethos is the credibility delivered in the speech rather than the attributes associated with the speaker (Braet, 1992).

The concept of rhetorical appeals has been interpreted in different forms of communication and from different perspectives. For example, Buchanan (1985) has a theoretical view discussing rhetoric in industrial design products. He defined the logos as technological reasoning, in which products communicate how they address technological viability and practical circumstances of use. Pathos is the emotion and desire element, in which the designed object reaches the level of fine art but for practical purposes. Ethos is the character and credibility reflected by the creator or manufacturer, which provide persuasion about the values of products and give confidence to users. Buchanan argued that logos bridges design with technology and science, ethos with ethics and politics, and pathos with aesthetics and fine arts. Buchanan, in the same essay, analyzed a set of industrially manufactured products like spoons, coffee mills, and lamps using the three persuasive appeals. His analysis is conducted for theoretical purposes and concluded that

technological development should be understood as human value and social consequence, which would make viable the rhetoric of design.

Another perspective is Ehses's pragmatic application of rhetorical appeals in graphic design (Ehses, 2008). He explained that in logos, strategies in design refer to the organization of information, choice of fonts, hierarchy, and consistency with the goal of facilitating understanding. For him, wayfinding design and instructional documents are logos-driven. Pathos strategies refer to special arrangements, visual symbolism, and choice of images and colors with the goal of triggering emotions. Advertising design is pathos-driven. Last, ethos strategies refer to the conceptual approach to provide credibility, empathy, and reliability. Graphic products with social, political, and health topics are ethos-driven. With these descriptions, Ehses provides broad categories of visual composition to configure the rhetorical appeals in graphic design products.

Although the theoretical discussion of Buchanan (1985) and the pragmatic definitions of Ehses (2008) provide clues to apply the rhetorical appeals in design, they are limited to *elementary* design products in rhetorical terms. While Buchanan used examples of products such as spoons and lamps, Ehses used posters and packaging.

Graphic design products for social change usually are complex products (e.g., health promotion animations). The researcher calls elementary design products those that have a short message or simple (utilitarian or symbolic) functions, such as a spoon or an informative poster. *Complex* design speeches are design products that have embedded a large amount of information and aim to change knowledge, attitudes, or behavior. In

other words, whereas simple design products, in rhetorical terms, are intended to *adapt* to the knowledge, attitudes, and behaviors of people, complex design products are intended to *change* them.

Additionally, the abstract separation of rhetorical appeals in Buchanan (1985) and Ehses (2008) may not be useful in complex design products because appeals are interconnected and vary throughout the experience of interacting with them. For this, Braet (1992) provided a useful reflection regarding the argumentative nature of the three rhetorical appeals. He revised them in Aristotle's work, seeking to assess if pathos and ethos could be considered enthymemes (argumentative). He first demonstrated that the logos appeal is the central enthymeme of a speech. He then explained that the pathos and ethos appeals could have two usages: one as indices shown (interpreted by the audience) and one as arguments proven (presented by the speaker). He explained that using pathos or ethos as enthymemes may counter the persuasion goal; for example, "attempting to prove *ethos* would produce doubt about the *ethos*! Only when one is certain that the *ethos* has been undermined by prejudices, can proving the *ethos* make sense" (p. 312). Also, enthymematic pathos could reduce the strength of the emotion or be useless. Braet concluded that in an effective speech, logos enthymeme or argument could be combined with ethos and/or pathos indices. Adapting Braet's interpretation in design means that logos is the core appeal of complex design products in which pathos and ethos indices could be added in greater or lesser degree.

Graphic design research using rhetorical appeals

There is limited graphic design research about rhetorical appeals analysis. Gregory (2006) reported a qualitative study in which she designed and analyzed two brochures, one with rational style that she calls information/argument and one with emotional style that she calls emotion/entertainment. The former focuses on clear presentation of facts and evidence. The later focuses on capturing attention with intrigue. The brochures content was about the risk of meningitis when drinking alcohol. She found that whereas the rational style is better for people that are already conscious of the risk, the emotional style is better for those who do not know about the issue. Although this study has a valuable finding, the researcher based her study on only one session with the participants and did not identify further actions taken by the participants.

Van der Waarde (2010) used Ehses' framework to conduct a rhetorical analysis of canons and persuasive appeals of medication pamphlets in Europe. He based his analysis on years of experience working with medical European commissions evaluating medical prescription directions. Rhetoric provided him with elements to report several flaws in the communication.

For logos, Van der Waarde (2010) described that pamphlets information follow a logical order required in the European directive for medical information. He argued that the overwhelming list of side effects compared to the short description of the benefit hinders patients' ability to make rational decisions. Additionally, whereas likeliness of side effects is provided, the effectiveness is not. The information is legal, but do not focus on

providing logical directions.

For pathos, he contended that the European directive restricts promotional messages and, hence, emotional appeals are unacceptable. Also, the experience of opening the pack and unfolding the pamphlets with large amount of information is intimidating. The information does not help to put the patient in a right emotional state of mind.

And for ethos, he contended that the character is ambiguous. Pamphlets are not clear in showing the origin of the information from the pharmaceutical industry, the doctor, the pharmacist, or the regulators, which reduces credibility.

Theoretical contributions of rhetoric

All theoretical endeavors described above demonstrate that a modern theory of rhetoric is a valuable contribution to the design field. For Buchanan (1995), the neo-positivist approach of design instituted by the Ulm School of Design in the 1960s can be expanded with the rhetorical humanism that reunites art and science. Perhaps this is the major contribution of this theory: its potential to integrate aspects of design traditionally seen as separated. As Buchanan asserted, a theory of rhetoric in design provides three levels of integration. First, rhetoric unifies theory and practice, which resolves the traditional rupture seen as a critical issue in the design field. The same rhetorical canons that are used in the design process can be used for design analysis. Second, rhetoric brings art and science together. The aesthetic expression is revalued as an essential factor

and merged with scientific demands of practical communication. Bonsiepe (2000) also highlighted the importance of the aesthetic experience, pointing out that it helps people to cope with complexity of information. The third integration suggested by Buchanan is to bring together all design disciplines, from engineering to graphic design, because all designed objects and systems contain and convey persuasive arguments and indices. Buchanan implied that rhetoric serves to build epistemological foundations of the field.

Also, the rhetorical approach helps design theory to become a modern theory, a theory of meaning. Further development is needed to reach the desirable status of dialectic theory. Additionally, the theory of rhetoric in design is still at a lower level of systematization in the classification of Parson and Shils (1951). The theory of rhetoric in design is a system of categories that show clear relations among them but seldom broad sets of explanations and predictions, and limited laws.

Regarding the operationalization, the theory of rhetoric may be either for analysis in design research or for production when used in design practice. This advantage positions rhetoric as a potential tool to make explicit design knowledge of the design practice. Although all design disciplines embody communication, graphic design scholars have unsurprisingly shown notable interest in rhetorical elements and particularly in rhetorical figures. It is recognizable that these figures are evident tools for the creation of graphics and information; however, they are not enough to study visual communication design products and process. The modern theory of rhetoric has extensive elements that provide integral framework for theory and practice of visual communication design and

the broad design field.

Clearly, rhetoric has been discussed in design research but more theory development is needed. Future design research should take advantage of all the potential of rhetoric. Particularly in graphic design, studies need to move from the semiotic paradigm limited to rhetorical figures and explore other rhetorical dimensions such as the rhetorical appeals.

2.2. Design for social change

There are several approaches to design that are related to the concept of social change. Nieuwsma (2004) explained that scholars and practitioners have explored alternatives to address social problems as a response to unequal consequences of conventional design. The alternatives include universal design, participatory design, ecological design, feminist design, and socially responsible design. He proposed a theory of appropriate design that reduces unequal social relationships and empowers marginalized groups.

In this section, approaches to design related to design for social change are reviewed. First, social design and design for developing countries are introduced. Second, universal design, which is also often referred as design for all or inclusive design, is reviewed. Third, functional literacy is addressed because it is the core human individual difference that determines ability in graphic design. Fourth, theories related to social change are reviewed. Last, the landscape of initiatives of graphic design for social change

and particularly health are reviewed.

Socially responsible design

Graphic designers reacted against the superfluous dominant role in advertising with the *First Things First* manifesto, which appeared in several periodicals in Britain in 1964. In 2000, a group of recognized designers updated and republished the manifesto (Barnbrook et al., 2000). The manifesto proposed a reversal of priorities in which design for culture and education is set above advertising design. It recognized the need of commercial graphic design but urged the exploration of new ways of cultural meaning and democratic aims. A radical intervention that embraces the manifesto is culture jamming, which is the use of graphic design for “anti-commercial critique” (Soar, 2002).

In the early 1970s, Victor Papanek, a major scholar in design for social objectives, introduced several ideas related to empowerment and social change. His major book, *Design for the Real World* – first published in 1971, is mainly associated with the concept of social design and design for developing countries; nonetheless, throughout the book he also reflected ideas related to universal and inclusive design (Papanek, 1984). One of his ideas of design is “do it yourself”, which he uses to encourage designers to empower people. He proposed designs open to the public, such as furniture that people themselves can build without paying the extra cost of patented designs.

Papanek (1984) criticized industrial designers’ excessive focus on trivial market needs that ignore the social context. He urged a socially and ecologically responsible

design oriented to genuine human needs. He argued that designers, before designing, should make ethical judgments to decide whether the project has a social benefit. Instead of reducing the profession to cosmetic gadgets based on quick obsolescence and waste, designers should center their attention on social needs, such as safety in transportation and products for health, not only in developed nations but also in the whole world. Papanek acknowledged that his claims are difficult for designers because their work is enclosed in a profit-based system. Today's state of the design profession reveals that Papanek's discourse is timeless because designers have had limited ability to overcome these issues.

Frascara, in his essays about graphic design, has insisted on the expansion of designers' social responsibility (e.g., Frascara, 1988). He argued that graphic designers' narrow concentration on aesthetics is insufficient. They should understand how information influences people and assure understanding, safety, and environmental protection. Frascara extended his ideas in a book (Frascara, 1997) that recommends the use of social research methods in graphic design, which aim to measure quality of visual communication by the behavior change in the audience. Margolin and Margolin (2002) also recommended social research methods in socially responsible product design but proposed close interdisciplinary collaboration with social science practitioners. Margolin and Margolin acknowledged the demand of designers' awareness of socially responsible design but criticized Papanek's view of social design as a resistance to market design. They argued that market and social design are "two poles of a continuum" (p. 25) and

proposed a model for social design inspired by the generalist practice of social workers.

An area of social design focuses on developing nations. Papanek (1984) described his experiences in developing nations and includes discussions about design problems in the third world. He observed difficulties of rush solutions from foreign designers and concluded that designers from the developing world can solve their own problems. Gui Bonsiepe, an alumnus of Ulm School of Design who worked in southern South America in the 1970s and 1980s, agrees with Papanek. He published a book called *Design for the Periphery* (Bonsiepe, 1985), in which he contended that developing nations need designers who create solutions for their own contexts. Recently, new perspectives that target developing economies have been called design for the base of the pyramid and design for emerging markets.

Universal design or inclusive design

Universal design is a design methodology that aims to create products that are usable for people with different ages and abilities (Story, Mueller, & Mace, 1998). The concepts of universal design, design for all, and inclusive design have a linked meaning. While in America and Asia the concept of universal design is more popular, in Europe inclusive design is. Universal design methods originated in areas of design related to space design, such as architecture and interior design, and physical objects, such as product design. For these areas, physical human factors are, with no doubt, central to the ability to use the space or product.

The fields related to interactive design (human computer interaction, web design, usability) have embraced the concept of universal design, attending the concern of creating digital interfaces that are accessible for people with disabilities. Newell and Gregor (2000), with the aim of integrating universal access in user-centered design, explained the similarity between universal design and inclusive design. They proposed their integration in universal usability, which is needed to extend user-centered design. Developments in this area have focused mainly on access for individuals with sight and hearing limitations.

Following the concept of physical disability in the specialty of graphic design, perception becomes the physical human factor that determines disability. Indeed, one of the principles of universal design is “perceptible information”, which refers to presenting information that is visually readable (Story et al., 1998). However, perceptive limitations may be a secondary factor when the problem of visual communication is observed from a cultural perspective.

Previous research has presented socio-cultural aspects in inclusive design. For example, Reed and Monk (2006), proposed a change of viewpoint in inclusive design from the object to the socio-cultural concerns. They explain that inclusive design is commonly applied to existing products to make them accessible for people with disabilities. This causes a conflict between universality of solutions and specificity of needs in different groups. Instead of starting with usability problems, designers should focus on the social and psychological issues and concerns of individuals with disabilities

such as social stigma, age discrimination, or personal independence. They suggested to denominate this approach as “design for inclusion” and argued that this approach should lead designers to address high-level issues and reduce the conflict between universality and specificity.

Although Reed and Monk’s idea (2006) addresses socio-cultural issues, these are limited to those issues of people with physical disabilities. The social and psychological needs of people without physical disabilities also need to be addressed. In this case, functional literacy emerges. It refers to the ability of individuals to interact with information and environment within his or her cultural context. Functional literacy becomes the core determinant of disability in “inclusive” graphic design beyond cognitive-perceptual limitations.

Functional literacy

The simplest definition of literacy is the ability to read and write language. But this definition has been constantly debated and revised from the middle of the past century. For example, Freire (1973) argued that a literate individual should be able to reach social well-being independently within his or her context. Freire linked literacy with the concepts of human empowerment and liberation. Also in the 1970s, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) proposed a definition of literacy oriented to work skills (Ntiri, 2009). Ntiri explained the definition of functional literacy as the ability to interact in the society and deal with the increasing

complex flow of everyday information. Ntiri's connection between literacy and information serves as a foundation to explore literacy as a core human factor for graphic design. Graphic designers are able to model the flow of information to facilitate inclusion by empowering individuals to access it.

Since graphic designers for social change are likely to work with unprivileged audiences, a critical challenge that appears is the design efficacy when the audience has limited functional literacy. Krampen (1968) suggested that graphic symbols could be used in developing countries to help communicate information among audiences with low literacy. He argued that design, for these countries, should be simple and realistic graphic symbols because the use of style or attractive expression may confuse the audience. Krampen's recommendation was narrow-minded by a western-centered worldview because it ignores the potential of local aesthetics and cultural symbols. Frascara (1997), interested in asking for human-centered and socially responsible orientation in graphic design, suggested that designers should incorporate issues of literacy to create information for life and social benefit.

Recently, Mejía and Zender (2010) reviewed the spectrum of physical, psychological, and cultural differences in visual communication design and concluded that the later two have more value. They argued that functional literacy merges the most essential human differences in visual communication design for social inclusion. The insertion of this practical variable of human difference facilitates design for social change.

The number of people with limited literacy and functional literacy is substantial. In the world, one-fifth of the population is not able to read or write a language; in the United States, it is 2% (United Nations Educational, Scientific, and Cultural Organization - UNESCO, 2005). Regarding functional literacy, there is not a world statistic. In the United States, functional illiteracy of people is close to a fifth of the population (14% below basic prose skills, 12% below basic document skills, and 22% below basic quantitative skills) (National Center for Education Statistics, n.d.). Therefore the world's population of functionally illiterate adults must be much larger.

Moreover, recent global changes and technological innovation have augmented the incidence of illiteracy when people lack, for instance, computer, health, or financial skills (Ntiri, 2009). Health literacy, which is a relevant concept in this dissertation, refers to a group of skills that provide the ability to understand and apply information in health situations and to navigate the health care system (National Research Council, 2004).

Audiences with limited functional literacies must be the main target of social design efforts, such as those regarding hunger, water access, disease prevention, or democratic participation. And so, social designers that target unprivileged and underrepresented populations need to understand the level of functional literacy of their audiences.

There is limited research in understanding the role of functional literacy in design. Remarkably, researchers outside the design field have explored how low functional literacy people use visual information. In health communication, for instance, researchers

often measure functional health literacy and compare communication efficacy among levels of literacy. Visual information has been often tested in the health communication for chronic diseases, which are more prevalent in communities with low income and limited literacy. In diabetes prevention and control, medical researchers have compared the performance of communication systems using graphics among individuals with limited literacy but have found modest results (e.g., Cavanaugh et al., 2009; Kandula et al., 2009). Van Scoyoc and DeWalt (2010) argued that because content specifically suited to low-literates has shown potential efficacy, future research in the content of education materials in diabetes for low-literate patients is needed.

In financial education, one example is Kozup and Hogarth (2008), who explained that functional literacy can be improved by acting in three areas: education, information, and policy. In the information area, they proposed the use of a “financial fact box” to help low-literate individuals in financial decisions. This fact box would be similar to those used in nutrition labels. These examples in health communication and financial education clearly imply that design research in visual communication accounting for functional literacy is needed. Human factors in inclusive design change in relevance according to the design specialization. In visual communication, functional literacy is the core determinant of disability. Thus, designers should create visual information that is comprehensible and usable for specific cultures and their functional literacy demands.

Although functional literacy is associated to underserved and disadvantaged populations, all individuals may be functionally illiterates when they are interacting in

uncommon contexts. For example, a traveler in a foreign country will encounter situations that lessen his or her ability to successfully interact in this particular society. In this case, language may be the main cause of exclusion. Places designed for international flows of people, such as airports, deal with this by including multilingual or icon-based communications. Another example is college freshman students; while they learn complex micro-social codes, they are functionally illiterates and need to depend on intensive orientation and peer collaboration in order to achieve successful social interactions. These examples also provide support to argue that the theory of literacy can supply theoretical elements for design research.

Social change

Social change refers to changes in people or the environment for a social benefit. Changes in people involve change in their knowledge, attitudes, and ultimately their behavior. There are different theories and models related to behavior. A seminal work in the area is the theory of planned behavior (Ajzen, 1985). In this theory, beliefs, attitudes, and intentions are causal factors of behavior and the perceived degree of control affect behavior execution. Although the theory of planned behavior acknowledges effects of external factors in behavior, it focuses on individual behaviors.

From an ecologic view, Maibach et al. (2008) explained that behaviors of people in the population depend on factors of people themselves and places. The people factors have three levels: individual (e.g., motivations, knowledge, intentions), social network

(e.g., family modeling, opinion leaders, social support), and community (e.g., social norms, collective efficacy). Places factors refer to availability of products and services, laws and policies, and cultural and media messages at two levels: local and distal. They argued that communication can influence people and place factors of behavior.

Heath and Heath (2010) provided a practical simple model for behavior change. They presented strategies of behavior change on three levels: rational, emotional, and environmental factors. They explained that people have a “rider”, which is a rational part and makes logical decisions, and an “elephant”, which is an emotional part and is guided by desires. To help the inner rider, a strategist could (a) repeat successful activities, (b) reduce ambiguity and number of choices, and (c) create an understandable and inspirational goal. To help the inner elephant, a strategist could (a) make people feel something, (b) make people think that the goal is close, (c) make people feel proud. And last, a strategy could change the environment by (a) changing the situation to make right behaviors easier, (b) building habits creating social norms, (c) creating collective behaviors that are contagious.

Genres of graphic design for social change

Initiatives of socially responsible visual communication design are diverse among target audiences, social issues, and object complexity. They may vary from strategies that target high-literate audiences (usually to promote awareness about certain social issue) to strategies that target low-literate audiences (usually to explain a misunderstood or

unknown issue). Applications also vary in social issues or topics such as financial education, democracy, and health communication.

The creative response of socially responsible designers has shaped a diverse landscape of visual objects and systems that may range from posters to dense interactive games. Genres have emerged as confrontational (e.g., culture jamming), educative (e.g., serious games), or collaborative (e.g., viral video activism). Culture jamming is a genre that uses advertising language with strong visual concepts to create anti-consumerism messages against corporations. A major reference in North America is Adbusters, which is a media organization that publishes a magazine and create campaigns about capitalism critiques. Memefest is a similar organization and festival originated in Eastern Europe that uses visual communication as a primary tool to contest consumerism. Culture jamming is a radical form of social design that engages in political criticism to make statements. Visual communication is usually still images or audiovisual clips that do not belong to broader organized structures of social action.

In the Internet era, there are new possibilities in design for social change. The digital medium is a social context that allows multiple forms of communication and interaction. Social media has extended the capacity of low-investment campaigns, which has been more effective when non-corporate, political, pro-social aims are in play. High quality visual communication has emerged with potential persuasive power, in part because it wisely uses rhetorical appeals. It depicts and criticizes social issues trying to persuade their audiences to act according to desired social behaviors.

A genre that takes advantages of Internet technology and social media is viral video activism. An example is the *Story of Stuff* videos (<http://www.storyofstuff.org>) produced by The Story of Stuff Project. The videos use animation and are narrated by Annie Leonard and discuss problems of irresponsible consumption and its status quo in terms of policy, politics, and economy. Recently, a video called *Kony 2012* (<http://invisiblechildren.com/kony/>) produced by Invisible Children remarkably reached more than 100 million online views in less than a month. The purpose of this documentary style video is to urge the arrest Joseph Kony, who is an Ugandan war criminal. Although these videos have a large impact, they often have extreme political positions that generate controversy. A variation of this genre is the use of videos to educate in non-controversial issues such as *RSAnimate* or PBS videos made for kids. *RSAnimate* (<http://www.thersa.org/events/rसानimate>) is a series of animated lectures given at the Royal Society of Arts in the United Kingdom. The animation aims to facilitate comprehension and engage the audience by using humor. These videos, rather than aiming for social activism, look for better comprehension of complex discourses.

Another genre is serious games, which are digital games “with purpose beyond just providing entertainment” (“Games and Meaningful Play,” n.d., para. 1). Their purpose may be education, health, or social change. Some of these games are short interactions that have a concrete message. For example, *Darfur is Dying* from the MTV channel, which had a considerable media exposure, can be played in less than 15 minutes, and the player can easily understand the difficulties for people in Darfur as a result of a

violent conflict.

Other games are more complex simulations and look for explanations of strategies or situations. For example, *A Force More Powerful* from the International Center on Nonviolent Conflict, explains how to organize activist groups to fight peacefully against political dictators and corruption. There is a general agreement that games are a useful educational tool. Authors like Prensky (2001) and Gee (2003) have studied the potential that video games have for learning. They argue that video game players are active and motivated in the interaction, which creates meaningful learning transferable to the real world.

Graphic design for health communication

Health information is usually communicated with verbal language written in pamphlets and orally in medical appointments. Visual language can be a complement to verbal language and increase comprehension in health communication (Houts, Doak, Doak, & Loscalzo, 2006; Katz, Kripalani, & Weiss, 2006). Even though literature in medication adherence proves that graphics are effective, studies are limited to single medications, which means that more research is needed in chronic conditions that demand multiple recommendations or medications in patients (Katz et al.)

Health communication researchers have surveyed studies on efficacy of health communication using graphic information (Anker, Senathirajah, Kukafka, & Starren, 2006; Houts et al., 2006; Katz et al., 2006). The type of graphics used in health

communication shows a focus on compositional elements that affect cognitive processing and perceptual accuracy, and health communication researchers have tested simple formats such as brochures or leaflets. Graphical information is basically used as a complement and has low visual complexity – for example, graphics that show how to take a medication in the day or statistical graphics that explain the risk of a treatment. There is limited research on more systemic graphic design products, such as a booklet or a website with several interfaces. Additionally, the majority of these graphics have appeals to reason. Health communicators have mainly relied on visualization of statistics and probability to induce health behavior change (Hinyard & Kreuter, 2007).

There are few studies that address appeals to emotion or character and propose more complex communication systems. One is Hoeken and Geurts's study (2005) that investigated the role of fear in health communication and concluded that it significantly affects health behavior. Another, by Thompson et al. (2010), reported the experience of creating a serious game for prevention of obesity and diabetes guided by behavioral sciences. The same research group later reported that the game positively affected health outcomes (Baranowski et al., 2011).

Applications in obesity and diabetes prevention and control

There have been and are multiple initiatives to tackle obesity in the United States. It is clear that there is no a single simple solution and recommendations have a wide scope from environmental to nutrition changes. Particularly, within visual communication and software applications there are several relevant examples that have

shown positive results. For example, Baranowski et al. (2011) reported modest positive results evaluating a videogame that promotes healthier nutrition and physical activities among youths. They contended that such serious games may have positive results, but a better understanding of mechanisms that affect behavioral change is needed before firm conclusions can be made.

In diabetes, there is research about the use of visual communication mainly for medication adherence and nutrition. Hosey, Freeman, Stracqualursi, and Gohdes (1990), after creating and assessing education materials with visual information for Native American diabetic patients, argued that visual material can aid comprehension. They also recommended studying patients' literacy when testing the design of education materials. Recently, Kandula et al. (2009) tested a multimedia program with visual information and compared knowledge gains in patients with different levels of literacy. Although all patients increased in diabetes knowledge, low-literate patients gained significantly less knowledge than high-literate ones. Cavanaugh et al. (2009) evaluated a diabetes toolkit with visual information designed for low-literate patients. They found that after 3 months of intervention, patients using the toolkit had significantly better health outcomes, but after six months there was no difference. These studies suggested that diabetes education materials that included multimedia and visual information may improve knowledge, but effects in low-literate patients are modest. This modest gain may be explained by the excessive focus on logic and cognitive understanding and lack of exploration of wider rhetorical appeals that may have a broader influence in different cultural groups.

These studies measure the variability of health literacy in the targeted population, which implies that diabetic patients tend to have limitations in literacy. These studies suggest that diabetes education materials that include multimedia and visual information may improve knowledge in low-literate patients; however, whether they cause positive health outcomes needs more evidence (Van Scoyoc & DeWalt, 2010). Content specifically suited to low-literates has shown potential efficacy; future research in the content of educational materials in diabetes for low-literate patients is needed (Van Scoyoc & DeWalt). Research in health communication for diabetes generates complex challenges in visual presentation, appeals, and content. Visual communication design can help if cultural and literacy characteristics are main focus factors in the creation process.

2.3. Theoretical framework

This section consists of two parts. First, the components of the theories of design, rhetoric, and functional literacy are briefly discussed. Second, a general theoretical model for design research in social change and social inclusion is proposed. Third, a model for this dissertation research is adapted based on the general model.

Components of the theory of rhetoric in design

Design scholars, who have proposed a modernized rhetoric in design, have also explored core ideas of classic rhetoric such as branches, appeals, canons, and uses.

Bonsiepe (1965) described the three branches or types of classic rhetoric: legal to implant opinions, religious to evoke moods, and political to make decisions. He argued that marketing to influence choice becomes a new branch for advertising design. His work centered on rhetorical figures for commercial design. Later, Buchanan (1985) also discussed the three classic branches and referred to legal, ceremonial or demonstrative, and political rhetoric, which are arguments about the past, present, and future. He suggested that although design objects arise from the past and suggest future actions, they primarily belong to the demonstrative rhetoric because they are “omni-present” declarations.

A second core idea of classic rhetoric is the three modes of persuasion or rhetorical appeals: logos (appeals to reason), pathos (appeals to emotion), and ethos (appeals to credibility). Buchanan (1985) explained these appeals as the three elements of design arguments, which allow the communication between the designer and the user. The designer aims to persuade people to become users of the product by using these three appeals, varying them in weight according to the rhetorical situation. For Buchanan, logos in design refers to practical use, pathos refers to practical art to cause desire, and ethos refers to the credibility of the manufacturer. The rhetorical appeals are further discussed in the next part of this section.

Classic rhetoric is also categorized into five canons or divisions for the speech creation process: invention (finding arguments), arrangement or disposition (ordering arguments), style (form of expression), memory, and delivery or action. Ehses (1984)

referred to them as the five phases for message production. However, he only used them to locate rhetorical figures in the style phase, arguing particular interest for graphic design. Buchanan (1995) expanded the relationship between the five canons or divisions and design. He proposed a matrix of abilities and disciplines of design where four rhetorical divisions (invention, judgment, disposition, and delivery) correspond to four disciplines (signs and images, physical objects, actions and services, and ideas and systems). He argued that expression or style is distributed in the four disciplines. Although Buchanan's categories develop the theory of rhetoric in design, he provided little explanation about how modern rhetoric supports these relationships.

Buchanan (1995) also used these divisions to define the rhetorical abilities of designers. He argued that invention allows designers to be creative beyond design specialties. Judgment provides ability to select appropriate solutions according to specific contexts. Disposition or decision is the ability to collaborate with other disciplines in the choice making of the design process. Delivery or evaluation is the competence to adapt manufacturers, user, and society needs. And expression is incorporated in all the abilities to provide "integrative aesthetic experience". Buchanan posited, "Design is the art of shaping arguments about the artificial human-made world" (p. 46). This premise positions designing as a rhetorical activity.

Perhaps the most essential concept for contemporary design thinking from classic rhetoric is rhetorical use or aim. The uses are analysis and production. Design scholars have generally agreed that rhetoric can be used for both analysis and production

(Bonsiepe, 1965; Buchanan, 1985; Joost & Scheuermann, 2006). Buchanan (1995) elaborated a particular interpretation of Aristotle and contended that analysis is part of poetics. He explained that rhetoric is concerned with the decision of making or how things may be and poetics is concerned with the analysis of making or how things are. In practical terms either rhetoric alone or rhetoric with poetics provide tools for design analysis and practice.

Components of the theory of functional literacy in design

The concept of functional literacy has limited development within the design field; however, a review of the literacy theory shows evident relationships. For example, Ntiri (2009) explained that literacy is associated with socioeconomic indexes, and it changes according to the context and content, which present special areas of literacy such as health literacy, civic literacy, or media literacy. These areas create action spaces for visual communication designers, because they imply specific rhetorical situations.

Recently, White (2011) proposed the Text-Task-Respondent theory (TTR) of functional literacy that creates a close relationship with design. Based on a large number of standardized evaluations of literacy done by the U.S. National Center for Education Statistics (NCES), White contended that literacy not only depends on the individuals (respondents) but also on characteristics of the information (text) and the difficulties of the activities (tasks). Interestingly, some of the literacy tests included everyday information such as job posts in newspapers or health care services forms. Although TTR

theory does not specifically account for cultural characteristics, it allows recognizing that literacy goes beyond the individual's ability and can be affected by designers that create visual communication (text and task).

Theoretical model for design research

In this section, the researcher proposes a model for design research that builds on theories of rhetoric and functional literacy, selecting the most relevant components for analysis and research in design as discussed in sections 2.1 and 2.2. The model focuses on applications of design knowledge for social change and social inclusion. Structural similarities among the theories allowed for comparison and identification of relevant elements in four categories: creator/producer, design method, design product, and audience.

Whereas there is no previous model that connects the theory of functional literacy to design, there are design inquiries that use the theory of rhetoric as a model for design analysis (e.g., Buchanan, 1985; Van der Waarde, 2010). Buchanan argued that products are essentially demonstrative, which diminishes the role of legal and political branches of rhetoric. He used the persuasive appeals (logos, ethos, and pathos) in his analysis. Van der Waarde did an extended analysis applying the model recommended by Ehses (2008). It consisted of three principles: situation (context, goal/exigency, and audience); speaker (background and intentions), and speech (five canons – *inventio*, *dispositio*, *elocutio*, *memoria*, *actio*; within *inventio* the three persuasive appeals are analyzed).

The researcher revised aspects in the theories of rhetoric, functional literacy, and design and found structural similarities using four core categories of each theory. These categories provide the possibility of building a trans-disciplinary model (see Figure 1 for similarities and the model). In the first category, speaker, designer, and text producer are correspondent because they refer to the creators of information. In the second category, canons, writing process, and design process are equivalent. In the third category, speech, text, and design product are the information or outcome in oral, written, or visual language. And in the fourth category, audience, user, and reader refer to people that receive or interact with information or outcome. This simple comparison with matching categories provides the possibility of building a trans-disciplinary model (see Figure 2).

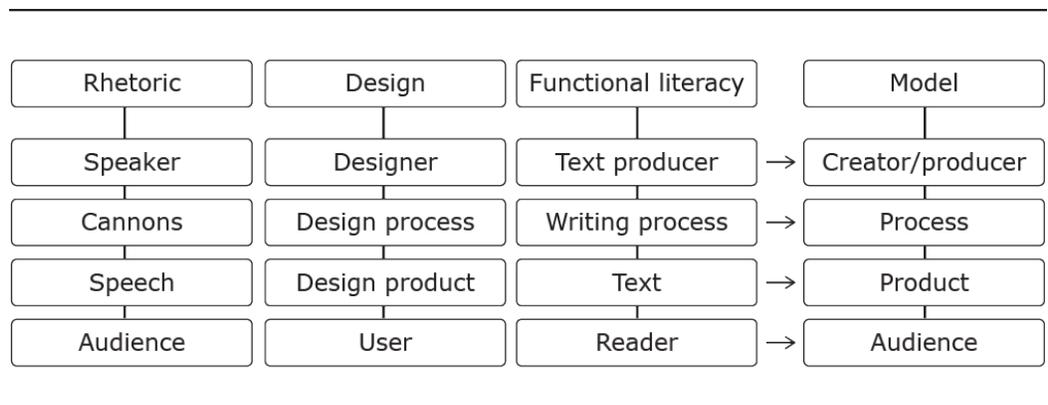


Figure 1. Structural similarities among elements of rhetoric, design, functional literacy and the proposed model for design.

The extension of the proposed model results from two analyses. First, elements of

the four categories of the three areas are examined. Second, these elements are interrelated and assessed according to the research aims in the field of design. The examination of theory of rhetoric assigns core ideas of the rhetorical toolbox into the structure of four categories (see Figure 2). The speaker category contains goal (exigency) and branch elements. The branch element was assigned to the speaker because he or she may define if the persuasion is legal, demonstrative, or political. The canons category contains the same five canons of classical rhetoric, as they are the processes of speech creation. The three persuasive appeals (logos, ethos, and pathos) are located within the speech category, because they describe characteristics of speech. The audience category

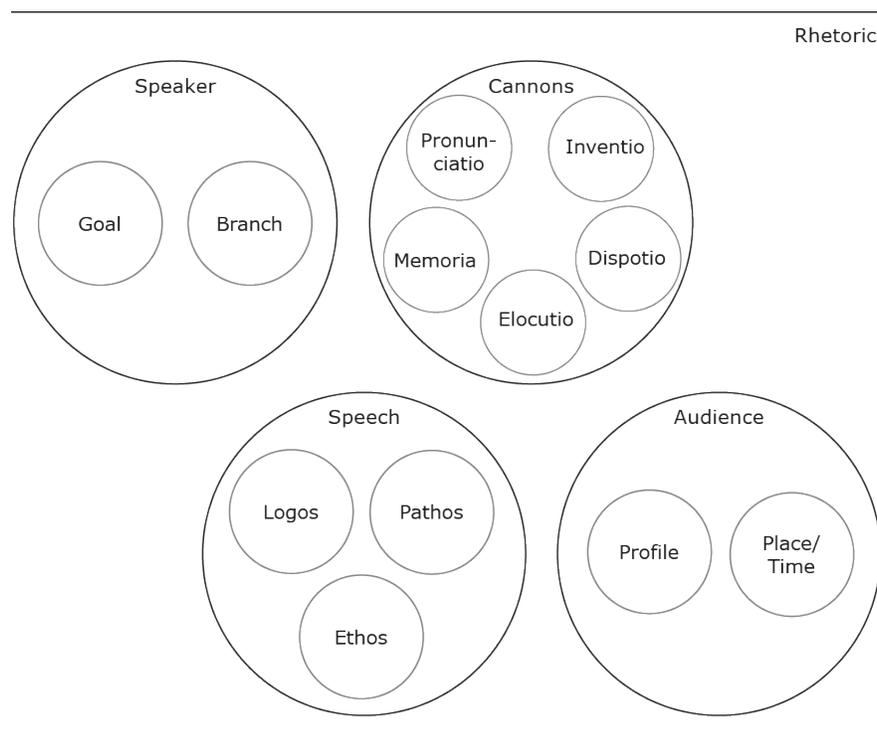


Figure 2. Elements of rhetoric.

incorporates concepts of the rhetorical situation including profile and context (place/time).

The examination of the design field explores designer, method, product, and user (see Figure 3). The designer category includes the designer himself or herself, the client, and their goals. In the method category, a simple and traditional three-stage model is used, which includes analysis, synthesis, and implementation. The design product category includes three functions: aesthetic, utilitarian, and symbolic. Lastly, the user elements give context to the design problem, including user goal, place, and time.

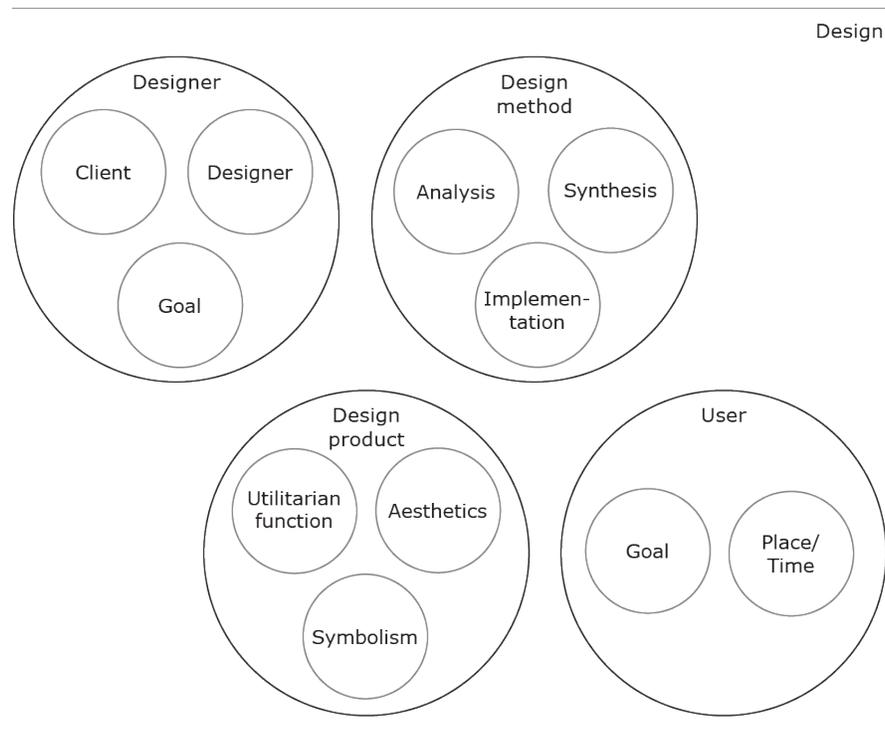


Figure 3. Elements of design.

An examination of the theory of functional literacy accounts for the cultural approach (Ntiri, 2009) and the TTR theory (White, 2011) (see Figure 4 for elements of functional literacy). The text producer category includes writer, editor, and publisher as the three most common roles, which produce the three types of text (prose, document, and quantitative) proposed in TTR theory. Theories of functional literacy do not focus on the creation process of texts, but a three-step standard process of writing is included: drafting, revising, and editing. Text category contains text features and task difficulty as proposed by White. Reader contains the respondent skills from TTR theory and the

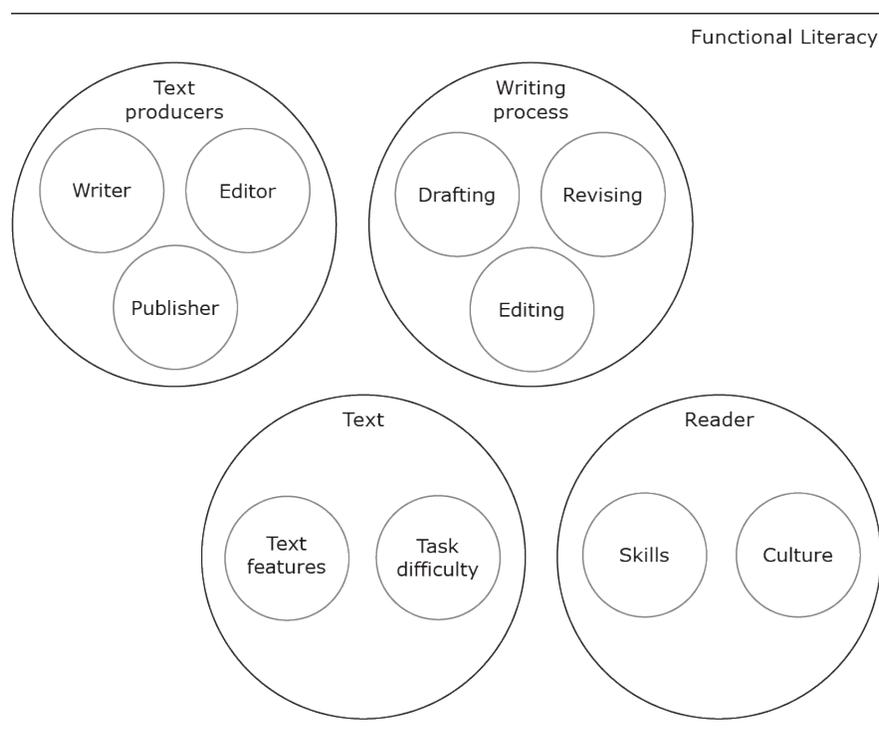


Figure 4. Elements of functional literacy.

element of culture. Ntiri argued that the latter is a constitutive part of the definition of literacy.

After the examination of elements, the next step was to assess all the elements of the categories to discern interrelations and more critical issues for design research. Although all elements in these categories may contribute, a simplification is needed in order to propose a practical model (see Figure 5 for proposed model). The first category of the framework is creator/producer, which preserves the elements of client, designer, and goal from the design theory. The element goal, which is also based on rhetoric, is

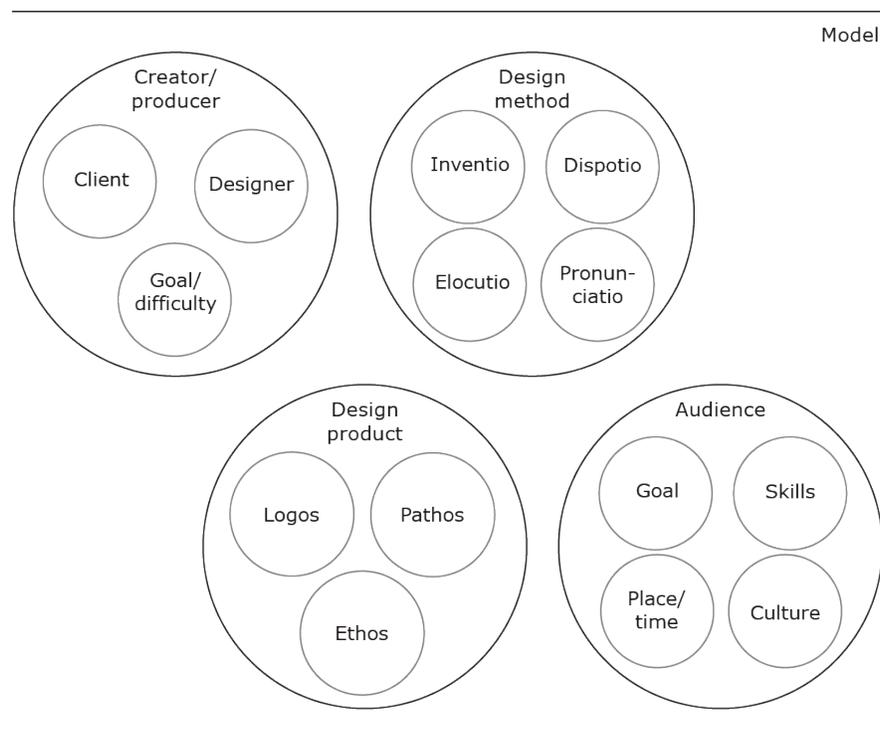


Figure 5. Theoretical model for design research connecting theories of rhetoric, functional literacy, and design.

associated with task difficulty (from functional literacy theory), because it can range from basic understanding to complex social change. The branches of the theory of rhetoric were not included because they offer little for the evaluation of the information or outcome. Branches mainly describe categories of speech, but they have similar challenges and complexity of persuasion.

The second category is design method and it includes four canons of the theory of rhetoric. These four canons match with the three-stage model of the traditional design method. *Inventio* is related to analysis; *dispositio* and *elocutio* to synthesis; and *pronunciatio* to implementation. *Memoria* was disregarded because design products do not rely on human memory for delivery.

The third category is design product, and its elements are the same as the persuasive appeals, because they provide a model for understanding communication between designer and audience. These appeals also have a sensitive relationship with the functions of design: *logos* and utilitarian function; *ethos* and symbolic function; and *pathos* and aesthetic function. As noted above, task difficulty from TTR theory was linked to the producers' goals. The text features were not included because they belong to a grammatical approach. This omission does not mean that design product features would be ignored in the evaluation; instead, they would be assessed through the lens of the persuasive appeals. For example, illegibility of typography can be wrong from a grammatical perspective but can be efficient if intended as an *ethos* appeal.

The fourth category is the audience, and it combines all elements of rhetoric,

design, and functional literacy: goal, place/time, skills, and culture. The concept of a profile of rhetoric is expanded by skills and cultural concepts of functional literacy.

The theories of rhetoric and functional literacy provide comprehensive components for a model for design to be used in analysis and research. Whereas the theory of rhetoric is an analytical and production tool, the theory of functional literacy strengthens the human factor in design from a cultural perspective. The proposed theoretical model for design combines traditional disciplinary components of the field with components of theories of rhetoric and functional literacy that are relevant for the analysis and creation of adequate human interaction with information.

Rhetoric is considered to be a creative and analytical tool for persuasive communication. It includes branches to analyze communication about different times, and persuasive appeals to analyze rational, ethical, and emotional content; it also includes canons to analyze the creation process of a message. Perhaps the major contribution of this theory is the potential integration of conflicting views of design. As Buchanan (1995) asserted, a theory of rhetoric brings art and science together. The aesthetic expression is revalued as an essential factor, and merged with practical demands of efficient communication. Bonsiepe (2000) also highlighted the importance of the aesthetic experience by pointing out that it helps people cope when interacting with the complexity of information. Rhetoric, then, could harmonize aesthetic, symbolic, and utilitarian functions – design aspects that may seem conflicting. The modern theory of rhetoric has components that aid theory development, and the practice of design.

Rhetorical views also integrate human factors and the message, because understanding the audience is essential for the rhetorical process. Since design focuses on usability and desirability, the human factor of functional literacy becomes a critical aspect of the rhetorical situation. Functional literacy, as the ability to comprehend the social environment, becomes a critical human condition for the design of visual communication. The model focuses on practicality by simplification, but future studies may not even apply all the proposed components or perhaps include other elements. For example, a study might only focus on the interaction between the persuasive appeals of visual information and the cultural bias of the audience. The promise of this model is the integration of aesthetics, expression, and utilitarian function by the rhetorical approach, as well as the identification of issues that affect visual communication design for social change, such as the understanding of human differences in functional literacy.

Theoretical model for this dissertation

Although the model proposed above is based on the analysis of existing theories and previous studies, grounded evidence is needed for further validation. This dissertation aims to generate evidence that utilizes variables that are components of the model. Figure 6 shows the model adapted to the issues addressed in this dissertation. In the creator/producer category, the goal is a component because the design products analyzed and evaluated shared a goal: social change. The efficacy of the products is assessed and measured in terms of change of knowledge, attitudes, and behavior. The

design product category includes all components of the original model and they are the central part of this study. In the audience category, culture, skills, and place/time are present because rhetorical situations depend on the context of the audience.

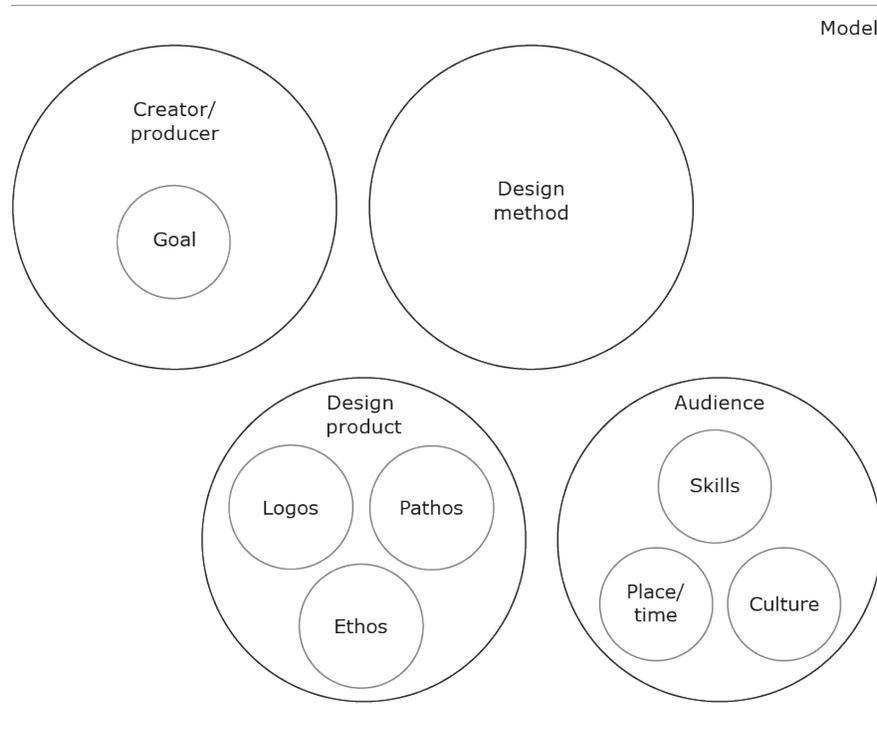


Figure 6. Theoretical model as adapted for the issues addressed in this dissertation.

In the supplemental quantitative data described further in the next chapters, elements of these three categories (the elements being goal, rhetorical appeals, and skills) work as variables. The social change goal of the creator/producer is the dependent or outcome variable. The configurations of rhetorical appeals in the design product are the

independent or explanatory variable. And the characteristics of the audience in terms of health skills is a mediator variable.

Design methods do not have any component for this dissertation; however, the rules of thumb that are derived from this study are intended to influence practitioners in the design process.

2.4. Design research methodology

Formulating a research project in the design field posits a special challenge because there are no research paradigms established in the field. The design research community is still debating how to conduct design research (e.g., Forlizzi, Stolterman, & Zimmerman, 2009; Sevaldson, 2010). The immaturity and interdisciplinary nature of the field, and the lack of agreement among scholars about what constitutes design research, hinders design researchers' ability to plan and execute it. This limitation is particularly true for research that is connected or related to design practice. "Designing" design research requires making four difficult decisions: (1) identify the limits of practice within research; (2) select the type of research frame – basic, applied, or clinical; (3) select the mode of design research – research about, through, or for design; and (4) identify a paradigm of research – post-positivism, constructivism, or pragmatism. This section discusses possibilities and considerations for these decisions in design research methods.

The goal is to map alternatives of rigorous design research and define possible roles of design practice. Distinctions between design practice and scientific research have

been discussed in the field of design. Cross (2006), for instance, argued that whereas designers focus on creating practical solutions, scientists aim to hypothetically create the optimum solution. Further, Krippendorff (2007) contended that there are contradictions between scientific researchers and designers' activities. For example, he argued that scientific researchers use the past to predict the future, whereas designers break the past to propose alternative futures. What may still be in debate is whether design research is a rigorous scholarly research activity. Design research may include, but is not limited to, design practice activities.

Cross (2006) understands design research as development, articulation, and communication of design knowledge. He argued that design practice alone is not research because it does not produce knowledge that can be reused by others. This idea provides a particular distinction between design research and practice, in which practice may be a beneficiary of research. Cross also proposed a taxonomy of design research that includes three categories: the study of designer behavior, the study of design methodology, and the study of design products. The diversity of these categories increases the complexity of defining design research methodology and paradigms. Additionally, the operationalization of design research is challenged by particular characteristics of design practice that conflict with traditional scientific paradigms.

Limits of design practice in design research

The similarity between basic processes of research and design is one source of confusion. For example, in both practices, there is a statement of the problem, and both require data collection. Those who confuse design practice and design research overlook two critical differences: the goal of the activity and the concept of innovation. First, while the goal in design research is to generate knowledge, the goal in design practice is to solve practical problems. For example a design researcher may want to know what is the best type size for children's books; he or she may test different type sizes in existing books or design books as instruments of research. If the design researcher decides to design books, the main goal is not to design books, but to use them as instruments in generating explicit design knowledge that can be reused by design practitioners. On the other hand, if a design practitioner is designing a children's book, one of the decisions is type size. He or she may want to do some non-scientific research by looking at other books, reviewing catalogs of book design, or studying how some children react to prototypes. In the former example the design researcher's goal is to test different interventions (type sizes), whereas in the later, the design practitioner's goal is to obtain information for design decisions.

A subtler confusion regarding the goal of the activity comes with the rise of usability testing. Designers may think that a design project that includes usability testing is scientific research; however, usability testing usually does not qualify as scientific research because of challenges with reliability and validity. Even if a usability study in a

design process includes large sample sizes or in-depth observations, the challenges may not be overcome. Additionally, a robust usability study that qualifies as scientific research will then have a goal that is different from the design goal.

The second difference between design practice and design research is related to the character of innovation. While researchers innovate by uncovering knowledge that has the potential to be applied to solve problems, designers innovate by creating artifacts and systems that solve problems. Also innovation is achieved with distinctive types of reasoning. A researcher that proposes an innovative theory based on research findings from a new study uses inductive reasoning. He or she starts from empirical data to propose generalizations. For example, a design researcher may find that people identify and remember red colored signs better than any other based on an experiment. He or she may conclude by induction that this is a design principle. Designers may apply scientific innovations in the design process. However, a designer that proposes an innovative artifact or system is not basing this on research and has a different type of reasoning. Martin (2009) explained that designers use abductive reasoning — a thinking process that explores what can be possible based on creative leaps rather than empirical data. Cross (2006) discussed this issue by explaining that designers use constructive thinking rather than analytical thinking. This need to use constructive thinking, he added, citing Rittel and Webber (1973), is caused in part by ill-structured design problems in which the problem-solver cannot access all of the necessary information to do extensive analysis.

However, this particular type of thinking in design practice does not mean that design research requires the same thinking process. Design research may need its own particular methods, but to neglect traditional research methods is a mistake. Yet, there is not clear agreement about the relationship between design practice and design research. For Friedman (2003), practice is only one of the sources, among others, of knowledge in design research. For him, design researchers engaged in design practice activities require systematic inquiry to produce design knowledge. For Cross (2006), design practice alone is not design research; practice must include a reflective activity, and knowledge must be reusable by others to be considered research. Sevaldson (2010) argued that multiple perspectives of design research should be acknowledged. He said that the field is moving towards a research approach in which practice is the core of research. Design practice is the only source of design knowledge; and the designer himself or herself in reflection generates knowledge. However, he did not explain how to execute that type of research.

Design research modes

Frayling (1993) proposed three modes of design research. Research *into* art and design refers to theoretical and historical research. Research *for* art and design is the gathering of information and materials and its result is the product itself. And research *through* art and design refers to reporting substantial results of a design project. Likewise, Archer (1995) distinguished three modes of research in art and design. Research *about* practice is very diverse in areas such as history, context, materials and so on. Research

for the purpose of practice is related to inquiries that contribute to the activities of practitioners. A major addition to Frayling's description of these two modes is that Archer stated they might also be addressed in fields other than design. For example, history issues pertain to the humanities, design in relation to people pertains to the social sciences, and research in materials pertains to the natural sciences. Lastly, research *through practice* is a type of "action research" in design. Archer emphasized that systematic procedures must be used in this mode of research. He also recognized the dangers of action research due to criticism that this method has received in the scientific community.

Friedman (2008) has rejected Frayling's taxonomy (Frayling, 1993), labeling it misleading, and argued that it has not helped bring clarity to the field. For him, Frayling's modes are only "intellectual probes" that need further development in order to become actual modes of research in design. Yet, Frayling's modes have had a large impact in the community and there have been subsequent interpretations and uses of them (e.g., Forlizzi et al., 2009; Sevaldson, 2010). Sevaldson proposed a new mode called research *by design* which attempts to refine the ideas from the mode research through design. It is an appealing proposal to categorize design research based on practice with rigorous reflection; though, he did not provide details about how to operationalize this. He presented some examples of possible research designs, but research techniques about how to collect, analyze, and report data are still unclear in this mode of research. To date,

neither research through design nor research by design are valid modes of knowledge production that could be recognized in the field as research.

Design research frames

Buchanan (2001) and Friedman (2003) have proposed using three frames of research that are recognized in other fields of knowledge: clinical, applied, and basic research. Clinical research refers to single problems or situations. For Buchanan clinical research is already widely used in design practice and design education when designers or students collect information to support decisions. He explained that case study, a type of clinical research, might be found in either design magazines or academic design journals; both may give insights into designers addressing other problems. Nonetheless, he added, only studies with systematically collected data, such as those found in academic journals, qualify as design research.

Clinical research is used in health sciences to test new interventions created in applied or basic research. In design this same approach may be used but it is unclear how, because design practitioners do not have to meet procedural and safety standards. In the health sciences, clinical research is used to assure the safety of an intervention before it is made publicly available. But in design, new principles or techniques that may even come from intuition or trends are not pre-tested because they do not tend to involve ethical issues or human risk.

Applied research refers to classes of problems or situations. Buchanan (2001) argued that the usual outcomes of this type of research are “rules of thumb” derived from several cases, and this is more rigorous than investigating a single case. He added that applied research might produce principles for certain types of problems or situations. In a clinical framework, the researcher may report a case study in detail, whereas in an applied framework, the researcher reports principles within a category of problems or situation. In the latter, not all details of a case study matter.

Lastly, basic research refers to general principles that are abstracted to cover multiple situations and help solve multiple types of problems (Friedman, 2003). Buchanan (2001) explained that this framework is rare in the design research community, and it is related to the theory of design.

Research paradigms

Post-positivist approaches in natural and social sciences value objective evidence gathered with methods that can be replicated. Conversely, *constructivist* approaches in the humanities and social sciences focus on the subjective interpretation of diverse phenomena and how people develop meanings from their experiences. Whereas post-positivist researchers primarily use quantitative methods, constructivist researchers primarily use qualitative methods of data collection and analysis (Creswell, 2009). Researchers across knowledge fields do not assume there is an absolute approach; rather, they acknowledge various fine-grained paradigms. A field can contain areas of research

that use multiple approaches with several specific paradigms. For example, medical researchers are mainly known for conducting experimental research, a post-positivist method, with evidence from large experiments such as medical clinical trials in chemical treatments. But there are areas within the health field in which more flexible paradigms have been adopted, such as patient education interventions that include mixed methods of data collection. Such flexible approach is known as *pragmatism*; it does not commit to any particular method and focus on real-world problem solving. A fourth paradigm is known as the *transformative* approach used by scholars that believe that research should actively change the world in favor of marginalized people.

Since the field of design has received historical dynamic influences from natural and social sciences and the arts, a design researcher is caught in epistemological dilemmas. Archer (1995) makes it simple, arguing that in design, depending on the type of question, the research belongs to certain discipline and should be conducted according to the methods of that discipline. For example, an investigation in materials within a situation related to design would use research paradigms of natural sciences. Even though there may be situations in which this is a valid path, this position is unsatisfactory because design researchers posit questions that exceed the complexity of supporting external fields of knowledge.

The researcher initially considered the constructivist approach for design research. This approach fits when studying designers' behaviors because the interest is on interpreting certain meanings of a particular human group. It also fits on investigations of

design products in terms of the meanings that people develop in interaction with them. The interest of design research is not on the meanings themselves however, but on how design products change meanings or how meanings affect the characteristics of design products. For example in graphic design, in a product such as a campaign, the main goal may be related to knowledge acquisition or attitudinal change. In this case, the product performance would be measured in terms of how it changes meanings of the audience. In another category of design products, such as way finding and web site interfaces, the goal is not to change meanings that people hold; instead the goal is to have the system make use of the meanings that people hold so as to guide their actions and interactions.

Although the constructivist paradigm offers epistemological foundations to design research, experimental methods of the post-positivist paradigm is also possible. The need of design principles could be more effectively satisfied performing research experiments. For this reason, design researchers should take a pragmatic approach because they are not interested in either the absolute truth of post-positivist paradigms or the cultural meanings alone of constructivist paradigms. This pragmatic approach will allow planning research across the diverse design knowledge needs that are emerging today.

3. Methods

As discussed in the first chapter, this dissertation seeks to examine rhetorical elements present in design products for social change. It focuses on understanding the use of rhetorical appeals (i.e., logos, pathos, ethos) in design products that positively change people's knowledge, attitudes, and behavior. The general aim of this research is to generate design knowledge and principles that help to create "useful, usable, and desirable" (Buchanan, 2001, p. 13) design products for social change.

Since research in this area is limited, this dissertation constitutes an effort to map issues related to design for social change from a rhetorical approach. For this reason, the research activities are exploratory and pragmatic, and they primarily use qualitative methods of data collection. The goal is to collect diverse data and contrast the findings to gain a profound understanding of the research problem.

This dissertation includes three stages: (1) analysis of design products, which consists of the analysis of rhetorical appeals in graphic design products for social change (i.e., four viral animated videos), (2) design project and designer behavior, which includes the design of a graphic product for social change (i.e., a mobile web application about childhood obesity prevention for Latino parents called *Lifecast*) and the auto-observation of the researcher-designer's behavior incorporating rhetorical appeals in a design process, and (3) evaluation of a design product, which consists of the evaluation of a graphic design product for social change (i.e., *Lifecast*) and the analysis of its rhetorical

appeals. In the first sections of this chapter the researcher describes the methods of each stage and discusses design research methodology issues regarding the limits of practice, the research frames, and the research paradigms. In the last section of this chapter, he describes the outcome of a design project for social change that was part of the second stage.

See Table 1 for a paired listing of research objectives and related questions.

Table 1.

Research Objectives and Questions

	Research objectives	Research questions
1	To analyze the rhetorical appeals in designed products for social change (i.e., animated viral videos).	How are rhetorical appeals configured in a successful category of design products for social change (i.e., animated viral videos)?
2	To design a product for social change (i.e., mobile web application) that has three modes of use with different configuration of rhetorical appeals.	How does the researcher-designer make decisions about rhetorical appeals in the design process?
3	To evaluate the efficacy of a design product (i.e., mobile web application) to positively change knowledge, attitudes, and behaviors.	What is the efficacy of a design product (i.e., mobile web application) to motivate use and positively change knowledge, attitudes, and behaviors?
4	To assess the rhetorical appeals in a design product for social change (i.e., mobile web application).	How are the rhetorical appeals configured in a design product for social change (i.e., mobile web application)?
5	To identify rules of thumb or design principles related to rhetorical appeals in design for social change.	What are some design principles related to rhetorical appeals in design for social change?
6	To explore design research methods and contribute to the current epistemological debate in design research.	What are the appropriate methods to do design research?

This research project had Institutional Review Board (IRB) approval and was conducted, in part, in a community health center (Hennepin County Medical Center) located in Minneapolis, Minnesota. This center serves primarily low-income minorities.

3.1. Stage 1. Analysis of design products

The first stage of the dissertation was a study of the rhetorical appeals in design products for social change (i.e., viral animated videos). The goal was to understand how successful design products use configurations of rhetorical appeals. The research methods in the first stage were rhetorical appeals analysis and expert interviewing.

For the rhetorical appeals analysis, the sampling process was purposive selecting of four successful animated viral videos, as listed below.

The first video is *The Story of Stuff* (The Story of Stuff Project, 2007), a 21-minute animation and presentation by Annie Leonard about the negative environmental effects of production and consumption of industrial goods (see Figure 7).

The second video is *Naomi Klein's Thought Bubble: Ethical Oil?* (Smart Bubble Society Inc., 2011), a 2.5-minute critique of Canadian sand oil impact on the environment and call for action against an oil pipeline narrated by Naomi Klein (see Figure 8).

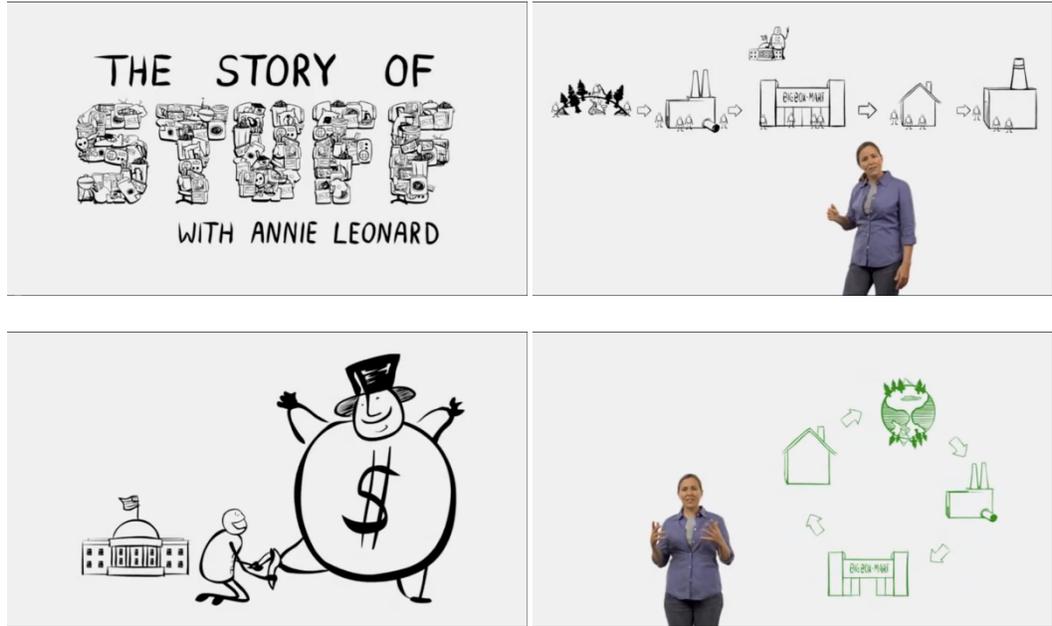


Figure 7. Sample frames from *The Story of Stuff*.



Figure 8. Sample frames from *Naomi Klein's Thought Bubble: Ethical Oil?*

The third video is *RSA Animate – The Crisis of Capitalism* (Royal Society for the Encouragement of Arts, Manufactures, and Commerce, RSA, 2010), an 11-minute lecture by David Harvey, animated with real-time drawings, that explains the oppressive effects of capitalism and claims the need for action (see Figure 9).

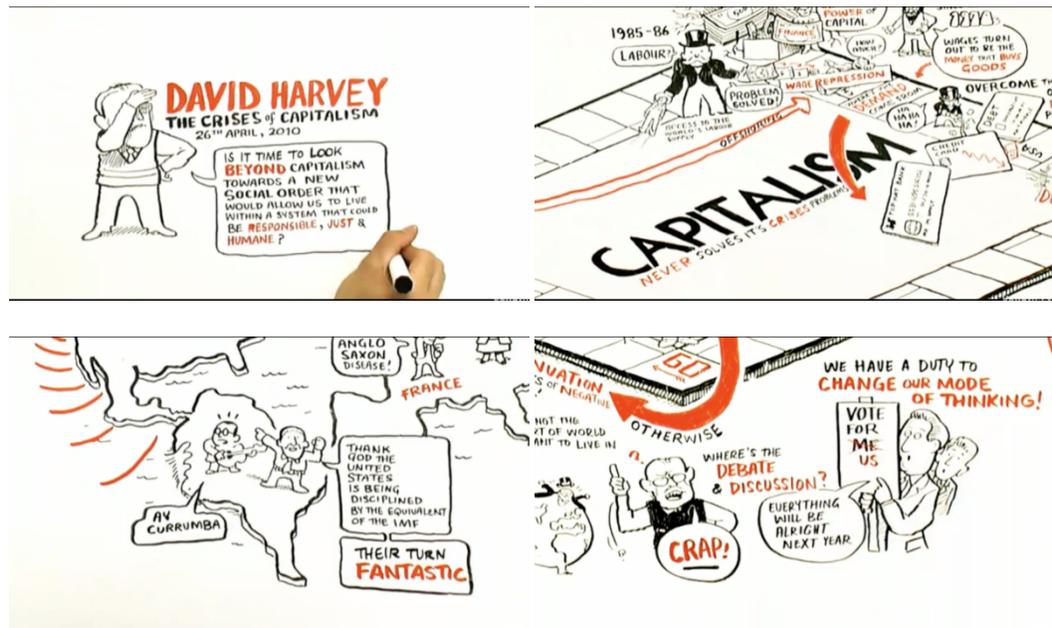


Figure 9. Sample frames from *RSA Animate: The Crisis of Capitalism*.

The fourth video is *PROTECT IP / SOPA Breaks the Internet* (Fight for the Future, 2011), a 4-minute documentary narrated by Kirby Ferguson and supported by information graphics that rejects a U.S.-proposed bill called PROTECT IP Act (Preventing Real Online Threats to Economic Creativity and Theft of Intellectual

Property Act), arguing that copyright industry may abuse censorship and lessen Internet freedom (see Figure 10).

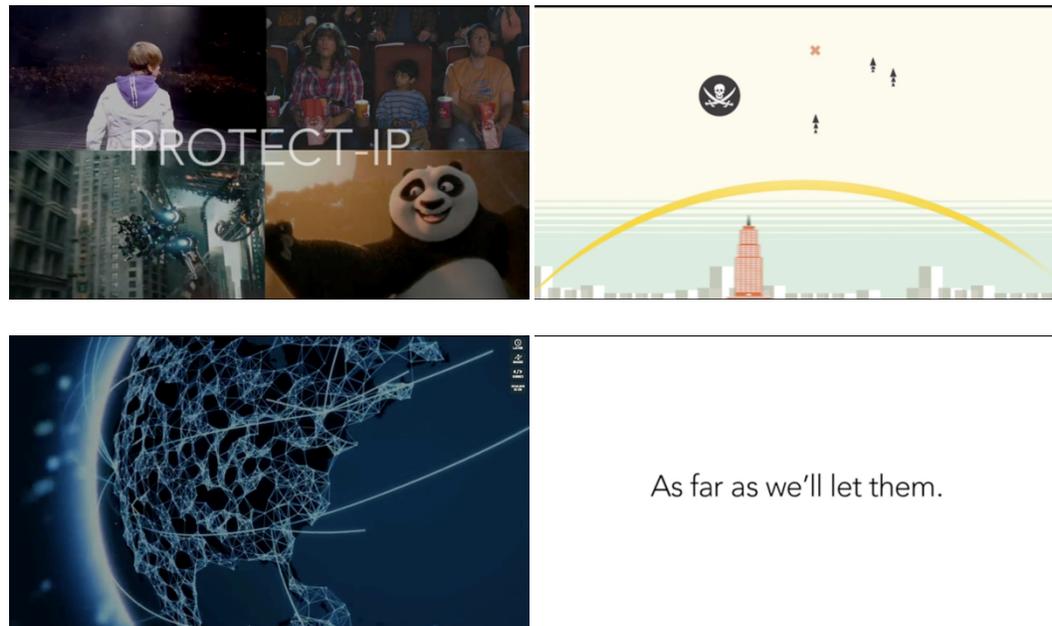


Figure 10. Sample frames from *PROTECT IP/ SOPA Breaks the Internet*.

The rhetorical appeals analysis of the products was a categorization of salient indices intended to appeal to logos (reason), pathos (emotion), and ethos (character). In design, as in classic rhetoric, rhetorical elements can be used for analysis of design objects (Bonsiepe, 1965; Buchanan, 1985; Ehses, 2008; Joost & Scheuermann, 2006). This analysis focused only on the videos; it did not include interactive elements accompanying the video, such as other website content or social media comments. The videos were reviewed to search for content and visual structures that use specific

rhetorical appeals. Data was coded and patterns were extracted to identify elements that contribute to appeal to logos, pathos or ethos. Then, patterns became the categories of analysis for all the videos.

There is not available evidence that measures whether these videos positively change knowledge, attitudes, or behavior of people. Nonetheless, the researcher assumed that the videos were an effective category for social change because they were viral and had a high number of views. For this, a supplemental analysis included was the review of online views. For this, the video posts and versions of the videos with more than 100,000 views were included. The data was captured on June 23, 2012, from two sites: YouTube and Vimeo. The data collected was number of views, days online, number of likes, number of dislikes, and number of comments.

For the expert interviewing, the researcher selected individuals who either were experts in the topics discussed in the videos or were people involved in design and production of the videos. The selected individuals were Matthew Taylor, chief director of RSA; Kirby Ferguson, producer of *PROTECT IP / SOPA Breaks the Internet* video; Michael O’Heaney, co-director at the Story of Stuff Project; and Edward Maibach, director of the Center for Climate Change Communication at George Mason University.

The interviews were semi-structured, lasted approximately 30 minutes each, and were conducted via phone call (see Appendix A for interview guides). The interviews were recorded and analyzed to find insights and patterns. Patterns were also examined, seeking to identify efficacy of rhetorical appeals.

3.2. Stage 2. Design project and designer behavior

This stage consisted of the design project to create a product for social change and the auto-observation of the researcher-designer behavior in decisions about rhetorical appeals. The purpose of the design project was to create an instrument for research, which is a design product with three modes of use. Each mode has a different configuration of rhetorical appeals. The purpose of the auto-observation of the researcher-designer behavior was to document how design decisions are made regarding the configuration of rhetorical appeals. The research method was auto-ethnography.

Design of a product for social change

At the beginning of the design project, the goals were to explore the design for social change with special awareness on the manipulation of rhetorical appeals, and specifically, to create an evaluation instrument that had more than one ‘rhetorical mode’ with particular configurations of appeals. Even though there are available visual materials for social change that could be used in research, the design of a new product was intended to ensure that other variables besides the appeals, such as composition, legibility, or format, did not influence participants’ comprehension, attitudes, or behavior. The modes were to have similar design quality and content but different configurations of rhetorical appeals.

For this purpose, the researcher looked for organizations in the Twin Cities that

could collaborate in the project. Topics in desired social change in health, democracy, and financial literacy were considered, but the first topic was selected because it involved less controversy. Staff in Hennepin County Medical Center were contacted and a program called Taking Steps Together, for prevention of childhood obesity, showed interest in the collaboration. Rachel Newby is the coordinator. Dr. Julia Joseph-Di Caprio, chief of pediatrics, and Patricia Barland, dietician, later joined to support the project.

The design problem was defined as the creation of an interactive tool for mobile devices about childhood obesity prevention targeted to Latino parents whose children are 6 to 12 years old. At this age, children enter school and begin to make decisions about diet and exercise. Initially, the researcher proposed that the design product might be composed of one or more materials in print, video, and interactive formats. An interactive solution was decided upon after analyzing the audience in the design project. The audience is parents of overweight children that are referred from physicians to the program Taking Steps Together. The majority are low-income Latinos living in Minneapolis and its adjacent cities. Low-income and minorities populations tend to have smartphones and use them to access the Internet: 49% of Latinos own a smartphone and 38% go online using smartphones (Zickuhr & Smith, 2012). The interactive media also allowed for creating dynamic information, as well as increasing the audience's motivation and curiosity.

The main outcome of the design process was a mobile web application about

childhood obesity prevention for Latino parents called *Lifecast* (see section 3.4 for details of the outcome). The application aims to change health knowledge, attitudes, and behaviors about childhood obesity in Latino parents in Minnesota – specifically, adult parents whose children are in the transition to independent diet and physical exercise decisions. *Lifecast* has three rhetorical modes: infographic, comic, and realistic. The textual and visual elements of the infographic mode focus on appeals to reason (logos) and appeals to emotion and ethos are reduced. In the comic mode, the textual and visual elements focus on appeals to reason (logos) and are enriched with appeals to emotion (pathos). In the realistic mode, the textual and visual elements focus on appeal to reason (logos) and are enriched with appeals to credibility (ethos).

To create a human-centered design process, the researcher sought responses from people representing the users in the design product's audience. He did this by including them in two steps of the design process. The design process included all of the following steps: (a) conceptual design and interface prototyping, (b) first research session with users, (c) conceptual and interface refinement, (d) software development – backend, (e) second research session with users, and (f) interface and software refinement.

The two research sessions with users were conducted using the recommended sample size of usability studies in which testing with four or five participants shows about 80% of usability issues (Virzi, 1992). The goal was to produce a high quality interactive design product. Both user research sessions included (a) interviews about participants' habits in diet, exercise, and media and (b) a usability test. Five Latino

parents participated in the first user research session and six other Latino parents participated in the second session. The number of children at each family ranged between two to six and each family has at least one child between the ages of 6 to 12 years. Only the parents participated at the usability test, and the researcher interviewed each parent separately. All interviews were conducted in Spanish. Before each session, a consent form was given to the participants.

The first user research session included (a) interviewing participants about habits and (b) conducting usability tests with a low-fidelity paper prototype. The objective of the first usability test was to improve the interaction design and visual rhetorical appeals in the application before developing the software. Parents for this session were recruited in a low-income neighborhood of Minneapolis at a Catholic church. Parents were asked to perform three tasks using the prototype.

The second user research session included (a) interviewing participants about habits and rhetorical appeals and (b) conducting usability tests with a high-fidelity digital prototype. The objective of the second usability test was to ensure quality of the interactive product. For the usability test, two parents performed the tasks in the infographic mode, two in comic mode, and two in realistic mode. Parents for this session were recruited in collaboration with Hennepin County Medical Center, in the childhood obesity prevention program called Taking Steps Together. Parents were asked to perform five tasks using the prototype.

Observation of the designer behavior

In this stage, an auto-observation was conducted of researcher-designer behavior related to the application of the rhetorical appeals in the design process. The observation was conducted in parallel to the design project. The research activity was a continuous reflection about how design decisions were made.

The auto-observation of the researcher-designer behavior is conducted from an auto-ethnographical approach by selecting relevant past experiences in the design process. To address reliability and validity, the researcher reports the narrative giving attention to credibility and verisimilitude (Ellis, Adams, & Bochner, 2010).

The goal of this activity was to reflect constantly on the challenges of the design process and to understand how the rhetorical appeals are applied in the design product. The data about the reflection was collected using a notebook. The note taking was irregular, but weekly on average during seven months. Data was analyzed and emerging patterns were coded. Then, key experiences and reflections were identified and reported as findings.

A limitation of this study is that the designer-researcher is Latino American, a member of the same cultural group as the target audience in the design project. Designing with understanding of the audience is an advantage in a rhetorical approach. Designing for a culture different from the designer's own culture will posit challenges unforeseen in this type of observation activity.

3.3. Stage 3. Evaluation of a design product

The third and last stage of the dissertation was to evaluate a design product, which is a mobile web application about childhood obesity prevention for Latino parents called *Lifecast*. The researcher evaluated the efficacy of the application and analyzed the configuration of rhetorical appeals in three modes of use of the application by conducting a design-experts evaluation and a real-context evaluation. The purpose of this last stage was to understand the efficacy of the design product to motivate use and change health knowledge, attitudes, and behavior, and to assess how the rhetorical appeals are configured.

Design-experts evaluation

The design-experts evaluation was the heuristic evaluation by experts in design and rhetoric about how the rhetorical appeals were used in the design product. Two professors of design with background in rhetoric were invited to participate:

- Hanno Ehses, retired professor from the Nova Scotia College of Art and Design; he has published several handbooks about design and rhetoric for college-level learning (e.g., Ehses, 2008); and
- Jessica Barness, professor of visual communication design at Kent State University; she completed an M.F.A. in design with a minor in writing studies (rhetoric and scientific/technical communication) at the University of Minnesota.

The experts were provided with an evaluation form, which included short descriptions about the research project, the context of the design product, and the audience. It included directions about the use of the application and how to change the rhetorical modes. The form had space for open comments and a questionnaire about rhetorical appeals (see Appendix B for the expert evaluation form).

Regarding the data analysis, the researcher observed similarities and differences in answers. Since the questionnaire used a Likert-type scale, averages of the answers from the two experts were calculated and used as a reference to compare results with the real-context evaluation.

Real-context evaluation

The real-context evaluation consisted of a fieldwork evaluation of the effects of the design product on the target audience. The researcher interviewed Latino parents in-depth before and after using the design product (i.e., *Lifecast*) to evaluate how it influenced their knowledge and attitudes. The sample was purposive, including key informants that were part of the target audience for the design product. The researcher found data saturation with nine participants and decided to stop further recruitment. Three parents used *Lifecast* in the infographic mode, three parents in comic mode, and three parents in realistic mode. The criteria to select the participants were as follows:

- Latino American individuals 18 years and older,
- Have at least one child between 6 to 12 years of age,

- Own a smartphone or be able to use one outside the health care center, and
- Able to read Spanish.

Only the parents participated in the interview; however, their children were occasionally present for part or all of the interview. The researcher interviewed each parent separately and all interviews were conducted in Spanish. Parents for this activity were recruited in collaboration with Hennepin County Medical Center, in a childhood obesity program called Taking Steps Together. Although individuals were not selected with a specific level of literacy, the researcher expected participants with limited functional literacy due to the location of the health center and the type of population served (i.e., low-income minorities).

The researcher had two sessions with each participant conducted using Spanish. In the first session, the IRB consent was obtained from each parent. Then parents responded to three questionnaires: a standardized functional health literacy test called S-TOFHLA (Baker, Williams, Parker, Gazmararian, & Nurss, 1999); a health knowledge test (see Appendix C); and a health attitudes questionnaire (see Appendix C). Then, the researcher interviewed parents using a semi-structured qualitative questionnaire guide (see Appendix D). Questions included issues of functional literacy, health knowledge, and health attitudes. The researcher took field notes and audio recorded the interviews.

Finally, parents received basic instructions about the use of *Lifecast*. Three parents used *Lifecast* in the infographic mode, three in comic mode, and three in realistic mode. The other two modes were hidden in the interface. The instructions included

explanations about how to select children characters, how to use the prediction tool, how to change habits, and how to read details about the health conditions. Since there was not a usability measurement goal in this stage, the researcher made sure that the parent understood how to use the application rather than test its usability. Questions about usability were answered right away. Parents were asked to use the application at least 4 times, each time at least 20 minutes, and to explore at least 4 children characters of the application. They were asked to do that the following two weeks and before the second session.

After a week, parents were called to remind them of the use of the application and to schedule the second session in the second or third week after the first session. In second session, parents were asked to confirm that they had used the app as directed. Most of them had, but some parents had used it for less time than directed or had not used it at all. Because three parents had reported difficulties accessing or using the application, the researcher assisted them for approximately 30 minutes before starting the second session.

Then the researcher repeated the health knowledge test and the health attitudes questionnaire and administered a rhetorical appeals questionnaire (see Appendix E). Next the researcher asked the parents to show how they used the application and took notes. Finally the researcher interviewed the parent using a semi-structured qualitative questionnaire guide (see Appendix F). Questions included issues of health knowledge, health attitudes, and rhetorical appeals. The researcher took field notes and audio

recorded the interviews.

Before the second interview, the researcher concluded that participants already had a high level of health knowledge and attitudes. Therefore, researcher asked open-ended questions about how the app was used and how it influenced the opinions of the parents and their families. He also read a short synopsis of the answers related to some unhealthy attitudes of the first interview and then asked participants how *Lifecast* may have influenced those attitudes.

After the interview, the researcher briefly showed the two rhetorical modes that had been intentionally hidden in the first interview and explained the differences among the modes to the parents. Then, he interviewed the parents using a semi-structured qualitative questionnaire guide (see Appendix F). Questions included issues of rhetorical appeals preference. The researcher also took field notes and audio recorded the answers.

Regarding the data analysis, the researcher used a personal technique of organizing data and codes, following the suggestion of Bloomberg and Volpe (2008). This technique consisted of reviewing raw data by listening carefully to the audio recorded in Spanish and reading interview notes, writing transcriptions translated to English, and coding and memoing data. After each interview and within the following week, the researcher reviewed, transcribed, and coded the data. Then, categories were predefined in a template according to the theoretical model (see Figure 6 for a diagram of the model) and research questions. However, the researcher remained open to codes emerging from data. Themes and codes were reviewed several times and as a result codes

were added, deleted, and collapsed in the process of data sense making. Finally, the researcher looked for design principles that emerged from codes.

Qualitative data was considered primary; however, the researcher collected supplemental quantitative data with two goals: to complement the qualitative data and to pilot instruments for future quantitative research. Quantitative data consisted of a functional health literacy test (S-TOHFLA), a rhetorical appeals questionnaire, a health knowledge test, and a health attitudes questionnaire. Functional health literacy was a mediator variable because the objective of the research is to evaluate if the rhetorical appeals (independent variable) predicts health knowledge and health attitudes (dependent variables).

The researcher used an existing functional health literacy test and developed the others. He administered a test of functional health literacy is called S-TOFHFLA, which is short version of the Test of Functional Health Literacy (Baker et al., 1999). The test measures an adult's ability to read information commonly found in health care. The researcher developed the health knowledge test and the health attitudes questionnaire according to the content of the informal curriculum of the application *Lifecast*. To improve validity, the collaborators at Hennepin County Medical Center reviewed the questions and made suggestions. And the researcher developed the rhetorical appeals questionnaire according to rhetorical heuristics regarding the three appeals using Aristotle's *On Rhetoric* as reference. There was not any validity improvement procedure for this questionnaire.

For the analysis of the quantitative data, the researcher ran various types of supplemental statistical tests. First, a paired t test was done to find if the intervention caused knowledge and attitudes changes. Then, a one-factor analysis of variance (ANOVA) was done to find if there is significant variance among the rhetorical mode groups. Also, Pearson correlation tests were used to observe if knowledge and attitudes changes are related to the level of functional health literacy. For all these analyses, two-sided tests with a p value of 0.05 or less were used to determine statistical significance. In addition to these tests, the researcher used descriptive statistics to report the parents' perception of the rhetorical appeals in the rhetorical mode that they used (see rhetorical appeals questionnaire in Appendix E).

Regarding the limitations, transferability of results to other contexts is limited because the study was conducted in a single U.S. Midwest city. Additionally, the sample recruited at Hennepin County Medical Center has special characteristics from a narrow population. The recruited participants were parents of children that were originally referred as overweight by physicians. In this situation, parents are likely to have had interventions from the physicians and other programs that have helped them to improve their functional health literacy, gain health knowledge about their children condition, and have healthier attitudes. The design product would have probably shown different efficacy in other parents.

The quantitative data is also limited in the small sample size; however, quantitative data is supplemental and experimental quantitative evidence is needed in

future research.

3.4. Design product outcome

This section is a description of the outcome of a design project for social change that was part of the stage 2. The purpose of the design project was to create an instrument for research, a design product with three rhetorical modes. The description of the design project outcome includes the design concept, the interactive design, the user research, the health content, the rhetorical appeals, and the software development. The subsections below contain these descriptions and are chronologically organized. The mobile web application is called *Lifecast* (www.lifecastapp.com, see Figure 11 for sample screenshots). The application aims to increase health knowledge and change health attitudes about childhood obesity in Latino parents in Minnesota.

Lifecast concept, interactivity, and usability were designed and developed in collaboration with the researcher's advisor, Dr. Sauman Chu. Additionally, staff in Hennepin County Medical Center supported the process by providing feedback on the design concept, the interactivity, and the health content. This staff included Rachel Newby, coordinator of Taking Steps Together program for prevention of childhood obesity; Dr. Julia Joseph-Di Caprio, chief of pediatrics; and Patricia Barland, dietician.

Other professionals were contracted for illustration and software development activities. Ellen Schofield illustrated characters for the infographic mode and food items (and will be referred to as the first illustrator). Nestor Tobar illustrated characters for the

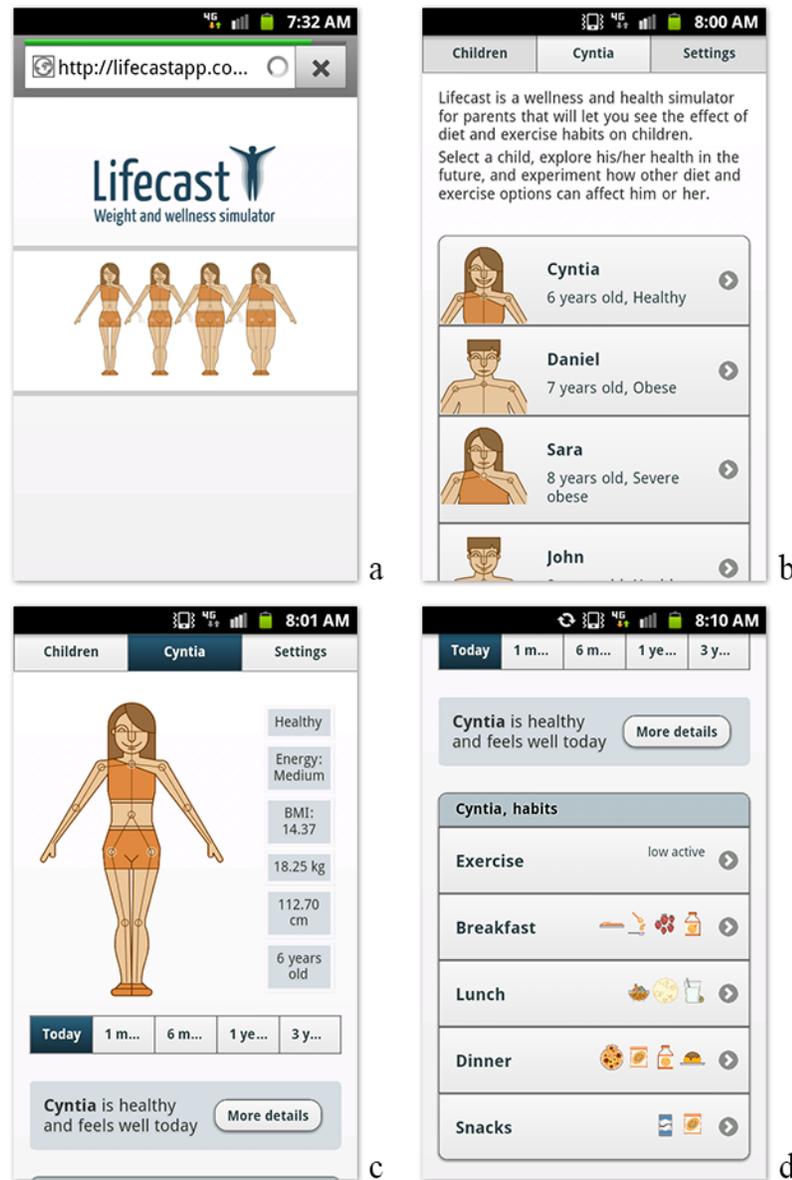


Figure 11. Screenshots of *Lifecast* in infographic mode.

a) introduction, b) list of characters, c) prediction in child, and d) list of habits in child.

comic and realistic modes (and will be referred to as the second illustrator). Cristian Gómez developed backend code in HTML and Javascript (and will be referred to as the engineer). The researcher had several roles, such as conceptual design, interactivity design, interface design, art direction in illustration, illustration editing interface design, usability testing, algorithm development for health prediction, and coding (HTML, CSS, and Javascript).

The researcher tackled several design issues in parallel, such as the interactive structure, the health content (about childhood obesity), the rhetorical modes, and so on. However, he focused on testing the general design concept and the interactive structure in the first session of user research. Then, the health content and the rhetorical modes were further developed and incorporated. Decisions about conceptual design and configuration of rhetorical appeals in the rhetorical modes were based on abductive logic (Martin, 2009) rather than deductive or inductive logics. Therefore, these decisions (e.g., drawing style of children bodies) were primarily based on intuitive creative leaps rather than evidence or user research. However, interactive design (e.g., navigation) and health content (e.g., habits) were substantially improved with the two user research sessions.

Design concept

The mobile web application (i.e., *Lifecast*) is targeted to a low-income Latino community: specifically, adult parents whose children are in the transition to independent diet and physical exercise decisions. The decision of designing for mobile media is

justified because low-income and minority populations tend to have smartphones and connect to the Internet with these devices (Zickuhr & Smith, 2012). Mobile media also allowed experimenting with an alternative way of delivering information in a more engaging and non-linear format than found in printed materials.

Lifecast works as an informal learning tool for parents. Parents are able to foresee the effects of diet and exercise in characters of children who are currently healthy, overweight, or obese. Characters in the application may relate to the parents' own children. The application is a playful and engaging environment that aids understanding of core concepts related to childhood obesity and healthy behaviors; for instance, the positive effect of fruit and vegetables, the need for physical activity, and the negative effects of processed foods. More detailed concepts such as effects of a particular food item or counting calories are not included.

The application is not a game because it does not meet the game rules (see Salen & Zimmerman, 2004); it does not provide a challenge for the user or demand a response with quantifiable outcome. Instead the application allows users to navigate different dietary and exercise options and learn how these changes affect the weight of the characters. It could be seen as a simulation tool that enhances understanding. Yet, the tacit goal is to keep all children characters healthy, which is culturally desirable. It is expected that *Lifecast* fosters health knowledge and healthy attitudes.

To illustrate the concept of how the app works, let's use John, one of the characters, as an example. John is 9 years old and is at healthy status. With his current

common daily diet and exercise, the prediction shows that he will be overweight soon and severely obese in one year. So, an alternative diet and exercise plan will be necessary. Parents can look up the exercise levels and construct meals by selecting food items from the application. Then, they will find out how different habits improve or worsen John's health. On the other hand, with someone who is overweight like Sara, the app can help the user to determine what habits would be helpful to change. The goal is not to encourage dramatic or fast-paced weight loss, but to encourage gradual change. Therefore, a character with overweight status might not show the results until a year or later.

Interactive design

The initial activities of the design process included the concept, first interactive design, and first session of user research. For the interactive design, the researcher created wireframes. A wireframe is a diagram that shows the interactive structure, functional elements, and content in a rough style. The advantage of this technique is that it allows solving the structural problem of interactivity before visually designing the interface, incorporating the content, and developing the software.

The first wireframe was created at the beginning of the process (see Figure 12). This rough diagram primarily served to communicate the initial idea and interactive concept to the project team (Dr. Chu, staff at the health center, and the engineer Cristian Gómez). The idea consisted of creating a tool in which the user could select patient

Mobile Web application, interactive design

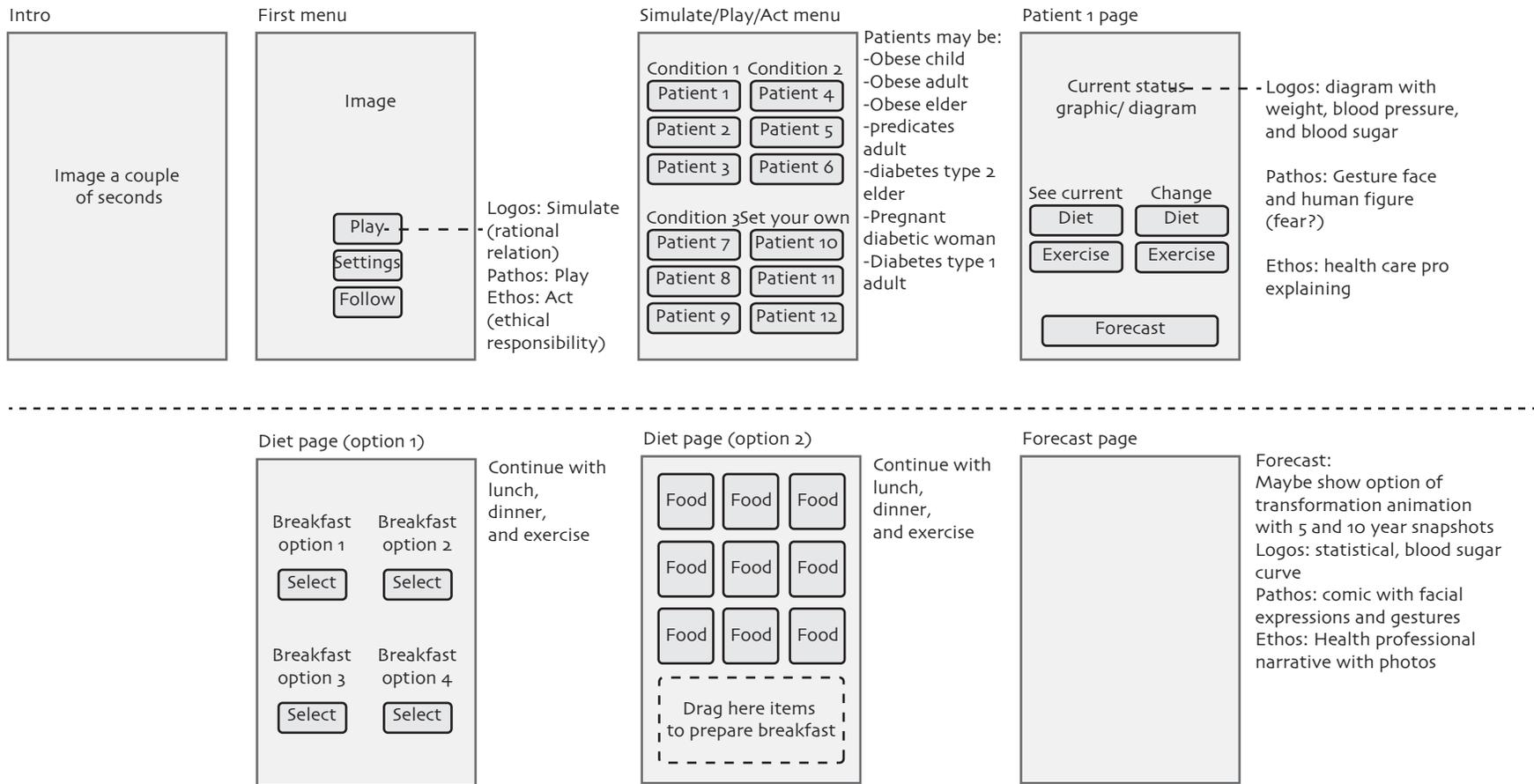


Figure 12. First wireframe for interactive design of *Lifecast*.

categorized by condition, including obesity and diabetes. In the patient interface, the user would be able to see the health status of the patient and select among current habits, change them, and forecast the health status. This diagram included the idea of having three rhetorical modes that were initially called logos, pathos, and ethos, matching the names of the rhetorical appeals. This version had several interactive issues unsolved, which is expected in a first iteration. The researcher tackled these issues in the following iterations according to the redefined target audience and scope.

One of the iterations of the wireframe was adapted for user research. This wireframe corresponds to the interactive structure of the low-fidelity paper prototype for usability testing in the first session of user research (see Figure 13 for wireframe and Figure 14 in the next subsection for paper prototype). When this wireframe was created, the design problem focused on childhood obesity prevention with an audience of Latino parents. Details were added, such as a page for settings within the application and another page for information about children's health. A major change consisted of merging the patients and forecast pages in a single one named child page. The objective was to show the health prediction immediately after a child character was selected. The child page was proposed using an interactive element called a slider, which is a drag-able button. The idea was that dragging the slider would show future body figures and moods of the children characters. The habits pages (meals and exercise) were designed as interfaces with four options that would have healthy and unhealthy meals or exercise levels.

Lifecast interactive design

index.html: single page application

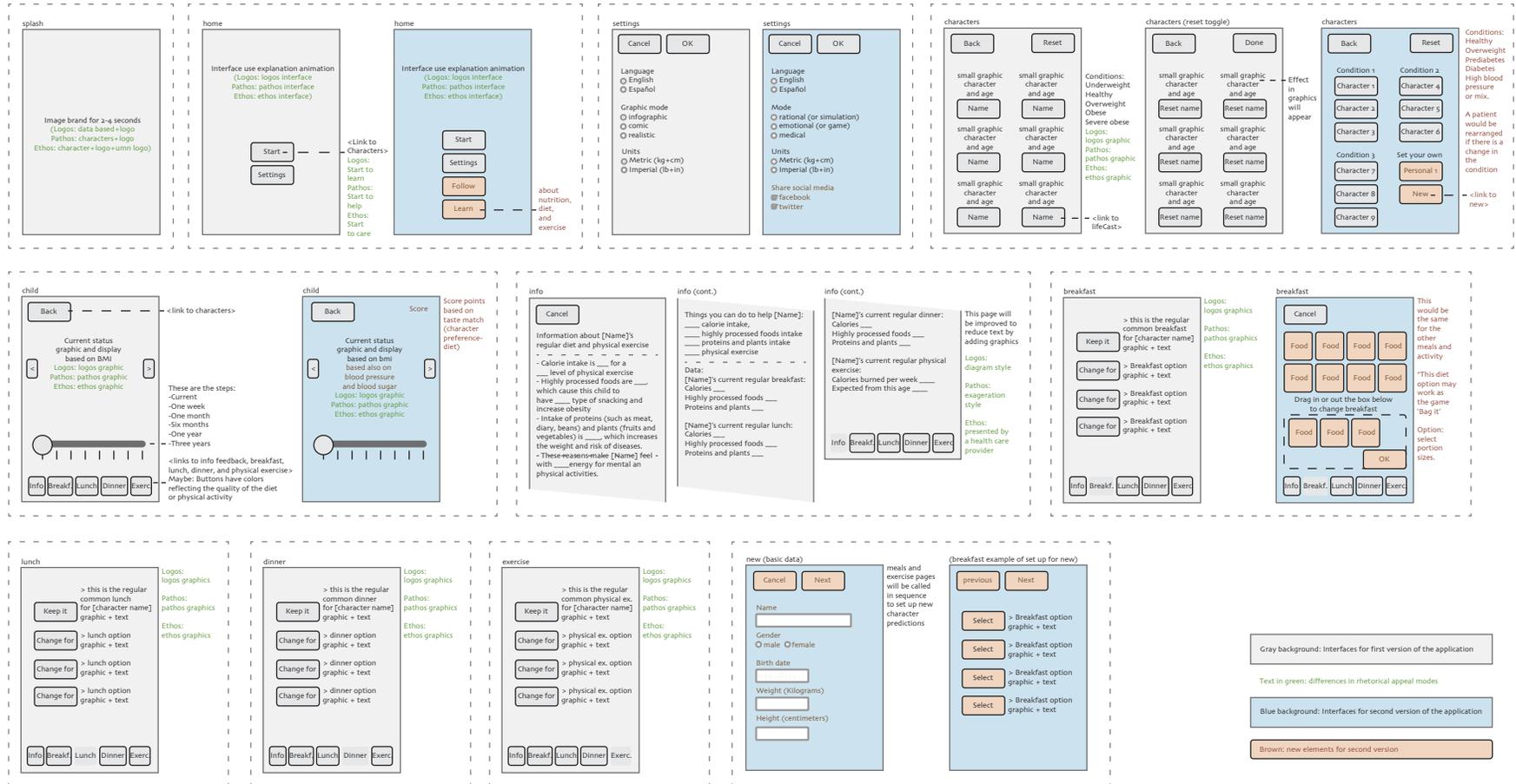


Figure 13. Wireframe for interactive design of Lifecast used as the base for paper prototype.

The interactive structure in this wireframe iteration also included functions for a potential second version that are presented using light blue and brown colors, unlike the rest of the structure, which is presented using light gray. These potential functions include social media integration; content to learn more about healthy habits; a function to create new personalized characters; the inclusion of blood sugar, blood pressure, and a score in the child page; and the function to build a meal selecting food items. The goal of including these functions in a different color was to register ideas, but these functions were not going to be included in the version for this dissertation in order to control the scope of the project.

First session of user research

As described in the previous chapter, five Latino parents participated in the first session of user research with an interview about habits and a usability test of the navigation. The data analysis from interview provided a basis for design decisions about diet and exercise content. The food items in the menu were later defined in a realistic way. The data from usability tests provided insight to refine the interactive design of *Lifecast*.

The researcher found similarities in the habit patterns of the participants' families. Most children have their lunch at school. Their meals are very regular with breakfast, lunch, and dinner for weekdays and in a quite fixed schedule for each meal. The most common food items that are consumed by majority of the families for breakfast are eggs,

pancakes, cereal, bread, bottled orange juice, and milk. Food items for lunch vary since they depend on the school lunch. Some common items include pizza, sandwich, soup with chicken and vegetables, spaghetti, and cheese. However, when it's a weekend, parents tend to serve their children homemade food such as quesadillas or enchiladas, which contain beans, rice, lettuce, tomato, and onion. Chicken tends to be a very common item for dinner with just different ways of preparation. Beef or vegetable soup is also popular for dinner.

Most parents know that fruits and vegetables are healthy food, but it seems that they need to force their children to eat these items. One parent found a creative way to get her children to eat vegetables: she cooks the rice with celery or mixes in vegetable juice with the rice.

All parents think that processed food includes canned food, food served in fast food restaurants, and microwaved food. Two parents think that frozen vegetables or meats are not good, which is a common misperception. Although most of these children participate in regular exercise, some of them have weight issues and have been advised by doctors or dietician on their diets.

Regarding the usability testing, the participants performed three tasks using a low-fidelity paper prototype (see Figure 14 for sample pages of the paper prototype). The first task was "Select a child and see what is his or her future weight." Participants did not notice the slider on the child page or understand that it was an interactive element. All of them failed to perform the task, and so the researcher needed to point out the slider and

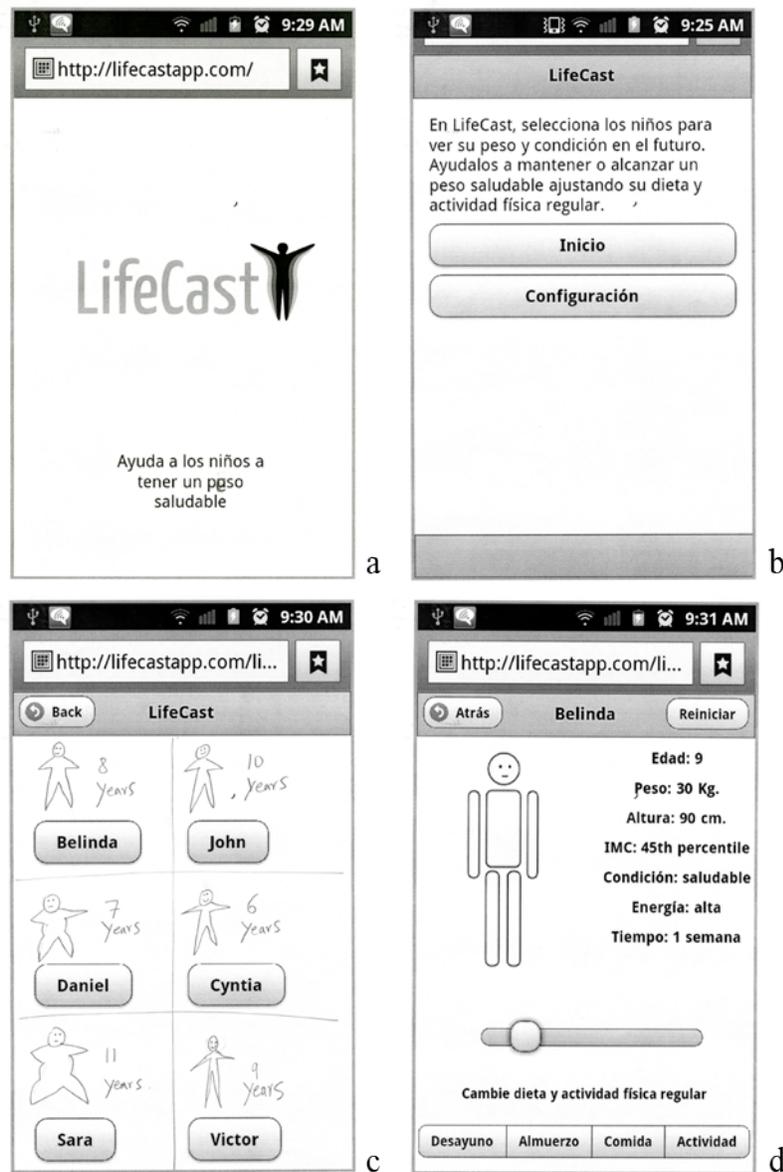


Figure 14. Low-fidelity paper prototype of *Lifecast* used in first session of user research.

show them how to use it since the slider was needed to perform the next task.

The second task was “Change the child’s habits and see again the future weight of

the child.” It was expected that the participants would click and look at the meals and/or exercise pages, change habits, and find out the changes on the character’s weight through dragging with the slider. Two participants successfully completed this task and the other four participants seemed to be lost and not sure what to do. Two participants commented that some icons and links were very confusing. One participant commented that she was confused by the graphic images.

The third task was “Find out the information details.” Participants clicked on the information button. However, this finding may be useless because the task direction included the word of the name of the button. The interactive design was refined based on the usability test outcome and discussions between the researcher and the project team members (see Figure 15 for refined interactive design). A main finding was that the navigation structure was confusing and relied too much on the back button. The navigation was redesigned, creating a persistent and simple top menu. This change was expected to create a better sense of place for the users. The habits page was created to allow the user to see a summary of common weekly exercises and common daily meals.

Although the researcher thought that the slider would be an effective interactive feature to show the health changes in time, the usability findings showed that it is not an appropriate approach. Most participants did not understand the purpose of the slider. Therefore, to show the advancement of time, clickable buttons were proposed. For instance, as a user clicks on the 6-months button, the shape of the character will change based on the new input of diet or exercise plan.

Lifecast interactive design

index.html: single page application

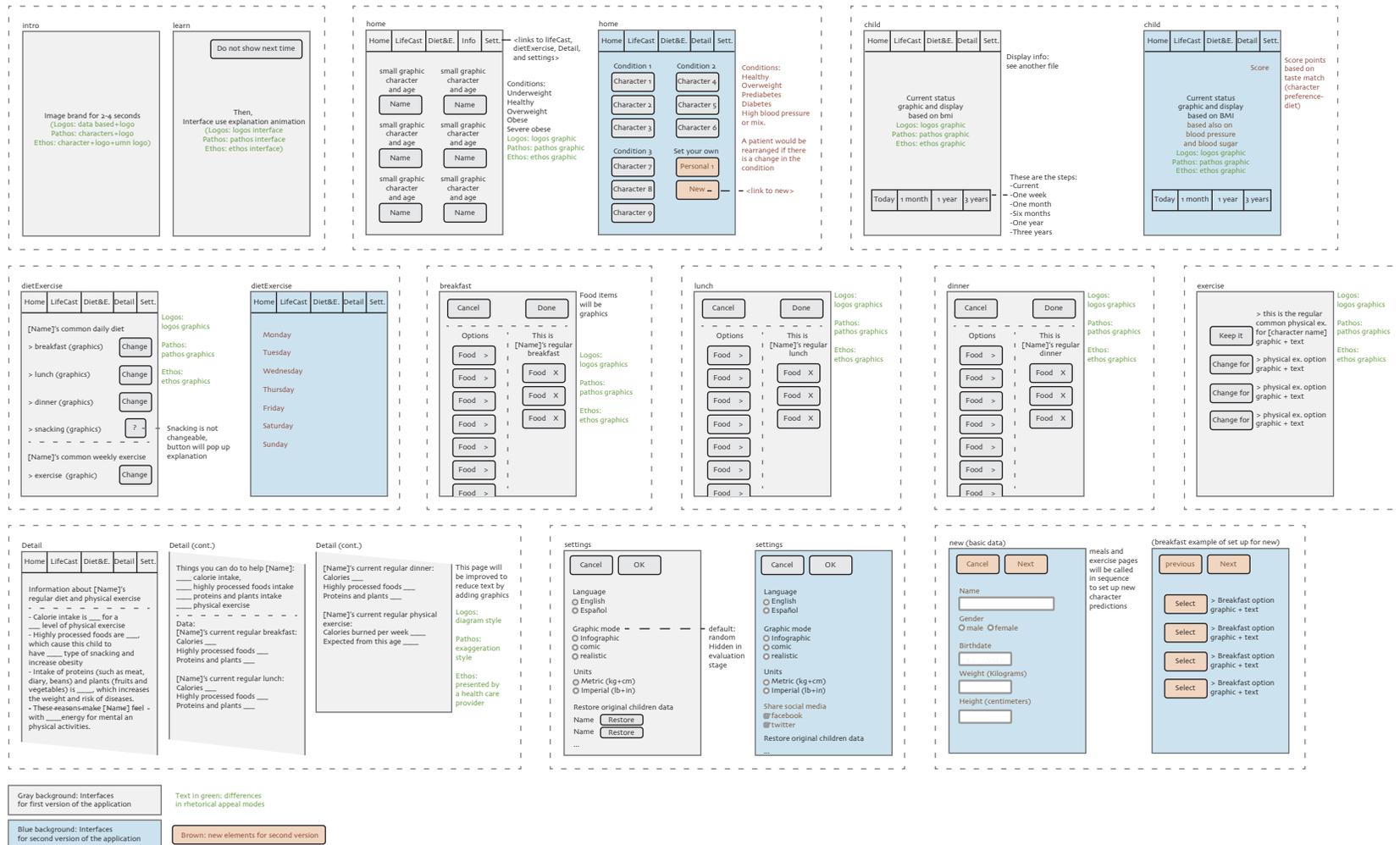


Figure 15. Wireframe for interactive design of Lifecast used in the digital prototype.

Health content and prediction algorithm

With a solid interactive design in place, having a precise definition of how the habits would affect the character's health became critical. In other words, an algorithm for health and weight prediction depending on habits was needed. This issue would also define the informal curriculum that parents would learn using *Lifecast*. Rachel Newby, program director of Taking Steps Together and Patty Barland, dietician, both at Hennepin County Medical Center, helped to define conceptual aspects related to health habits.

The researcher-designer defined five core concepts for learning with the application related to the effects in health expressed in weight, mood, and energetic feeling of the children characters.

- Physical exercise has a positive effect.
- Uncontrolled screen time (TV, computers, phones) has a negative effect.
- Fruits and vegetables have a positive effect.
- Foods with proteins have a positive effect.
- Highly processed foods have a negative effect – or whole foods have a positive effect.

Secondary concepts present in the application include the following.

- Too high or too low food intake (calories) is unhealthy.
- Parents have control on the content of meals, but not on the snacks.

- A poor diet causes children to consume more unhealthy snacks.
- Parents should not force children to exercise but should motivate them.

With these concepts in mind, the prediction algorithm was proposed. It was based on dietary and exercise recommendations of the Institute of Medicine of the National Academies (2005) and the growth charts published by the U.S. Center of Disease Control and Prevention (2009). *Lifecast* shows common daily habits of the characters that the user can change. These habits are used to calculate the health prediction. Though the application is not a portrait of actual characters, it is a device by which people can understand the impact of their actions in real life.

The algorithm makes its calculations in the following sequence. (1) First, it calculates energy requirements according to gender, age, weight, and level of physical activity. For healthy and underweight children, the formula for estimated energy requirements (EER) is used and for overweight, obese, and severely obese children, the formula for total energy expenditure (TEE) is used. (2) Then, the algorithm calculates energy intake. Every food item in the meals options has a value in energy (kcal) and scores in wholeness, plant content, and protein content. The snacks are not controllable by the user. Total energy intake is calculated summing up energy from meals and adding a percentage of snacks. The percentage base for snacks is 20%; it increases if wholeness, plant, and protein score averages are low and decreases if averages are high. This means that a poor diet in meals will increase unhealthy snacks and, hence, energy intake. (3) Finally, the algorithm calculates weight gain or loss in every time step of the prediction

(e.g., 1 month, 1 year), comparing the expected growth of the children with the added energy imbalance.

The visual appearance of the body of the characters in *Lifecast* is based on the Children's Body Image Scale (Truby & Paxton, 2002). This scale shows seven levels of adiposity (underweight, four healthy, overweight, and obese) with seven boys and seven girls ages 7 to 12 years. The graphics in this scale display photographs of children belonging to percentiles according to the levels of adiposity. *Lifecast* uses eight levels of adiposity: seven graphics were based on this scale and the severe obese level was added augmenting the visual weight appearance of the obese level in the scale.

Figure 16 shows an example of the prediction in realistic mode showing changes in the character body image, mood gesture, weight, energy (energetic feeling), and BMI. The infographic mode also shows height and age change. Feedback information is also given with a message below the time navigation menu and in the content of the information details page. The later can be accessed in the 'more details' link.

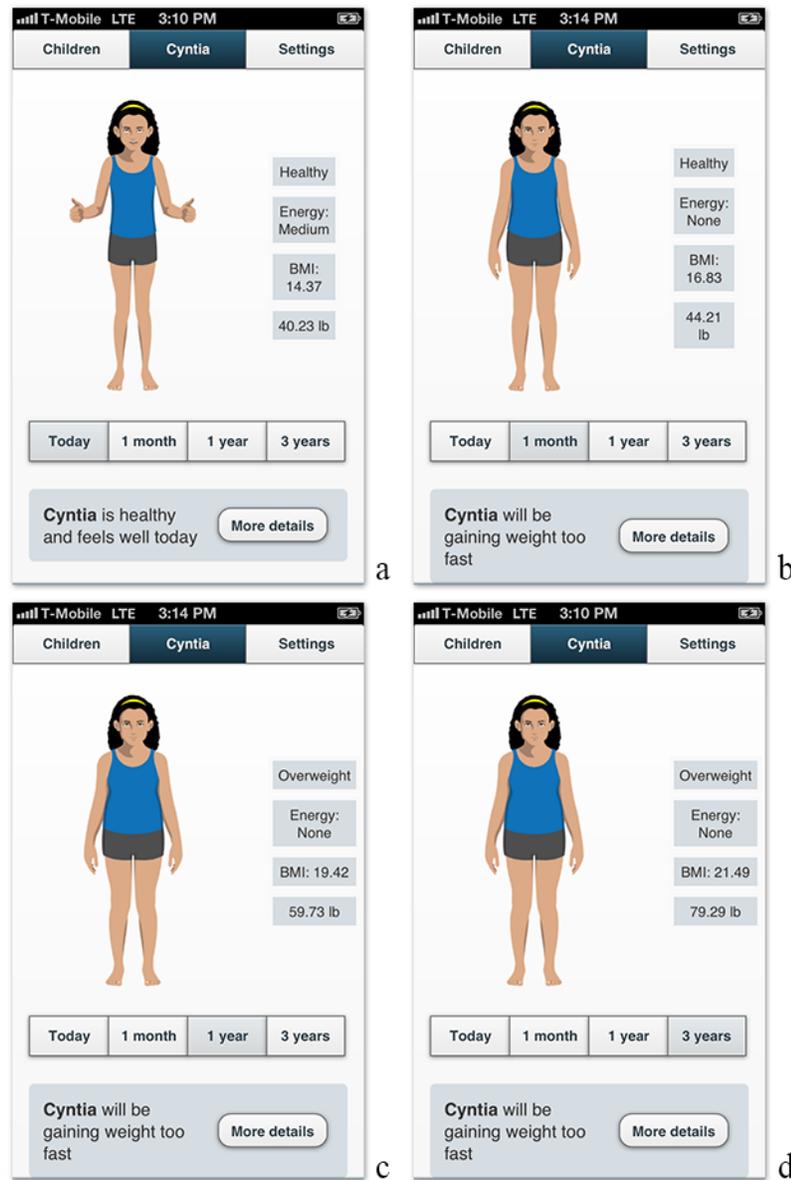


Figure 16. Screenshots of prediction page for a child character in realistic mode of Lifecast.

a) today, b) 1 month, c) 1 year, and d) 3 years.

Rhetorical appeals

The exploration of the rhetorical appeals seeks to provide alternatives to optimize the designed interface and to increase the persuasive elements in the interaction, which is expected to improve the engagement of the audience and, therefore, increase their knowledge, change their attitudes, and stimulate healthy behaviors.

Lifecast has three rhetorical modes of use, each with a specific configuration of rhetorical appeals. One mode, called infographic, focuses on a rational argument, which uses simplified verbal and visual elements (see Figure 17 for sample screen shots of infographic mode). The other two modes also use a rational argument, but were enriched with pathos and ethos indices. The comic mode has more pathos indices (emotion) (see Figure 18 for sample screen shots of comic mode) and the realistic mode has more ethos indices (credibility) (see Figure 19 for sample screen shots of realistic mode). For example, the realistic mode uses the University of Minnesota brand as an index of credibility. The comic mode uses short personal stories for the characters as an index of emotion.

The researcher-designer referred to rhetorical appeal concepts in the literature and the previous analysis to make decisions about the appeals in the rhetorical modes. These concepts were inspired in Aristotle's *On Rhetoric* book (Aristotle & Kennedy, 1991), Ehses' (2008) operationalization of the appeals in graphic design, and the salient appeal indices identified in the first stage (see 4.1 for a list of indices). The developed guiding concepts were applied to textual and visual elements. The design concept, the interaction,

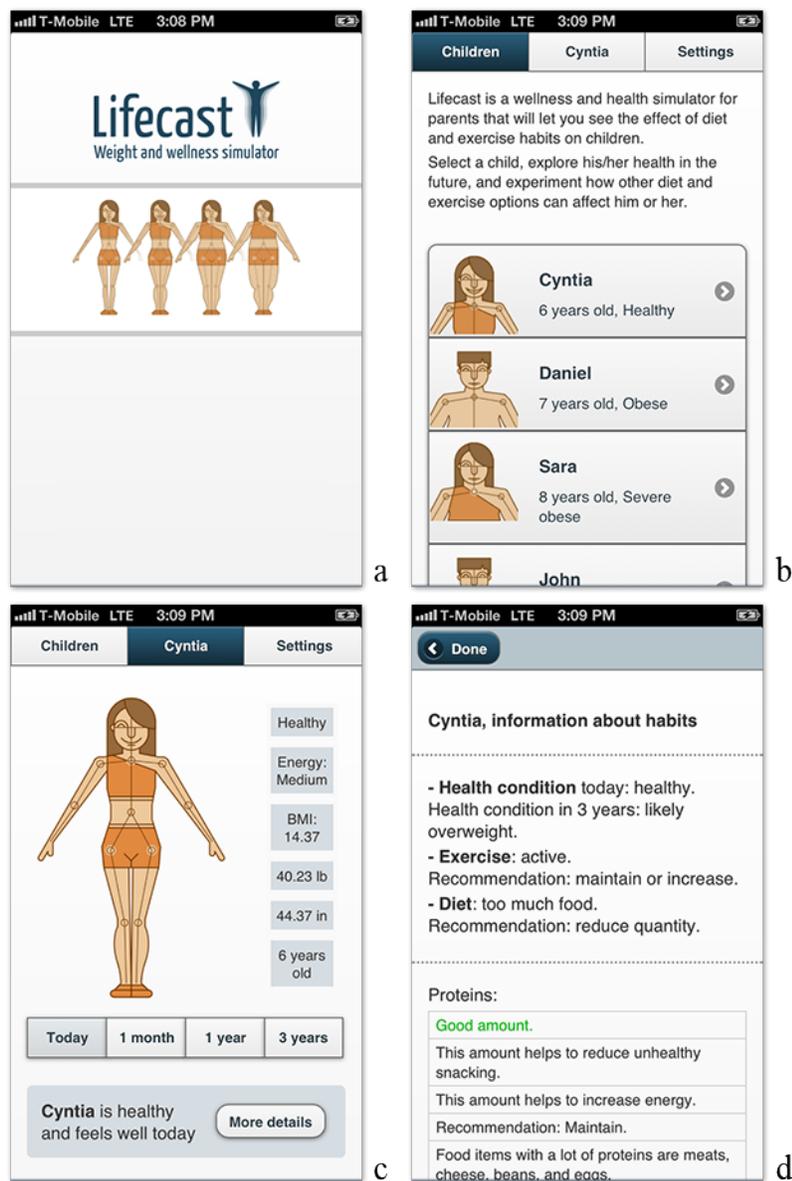


Figure 17. Screenshots of pages in infographic mode of Lifecast.

a) introduction, b) home, c) child, and d) information.

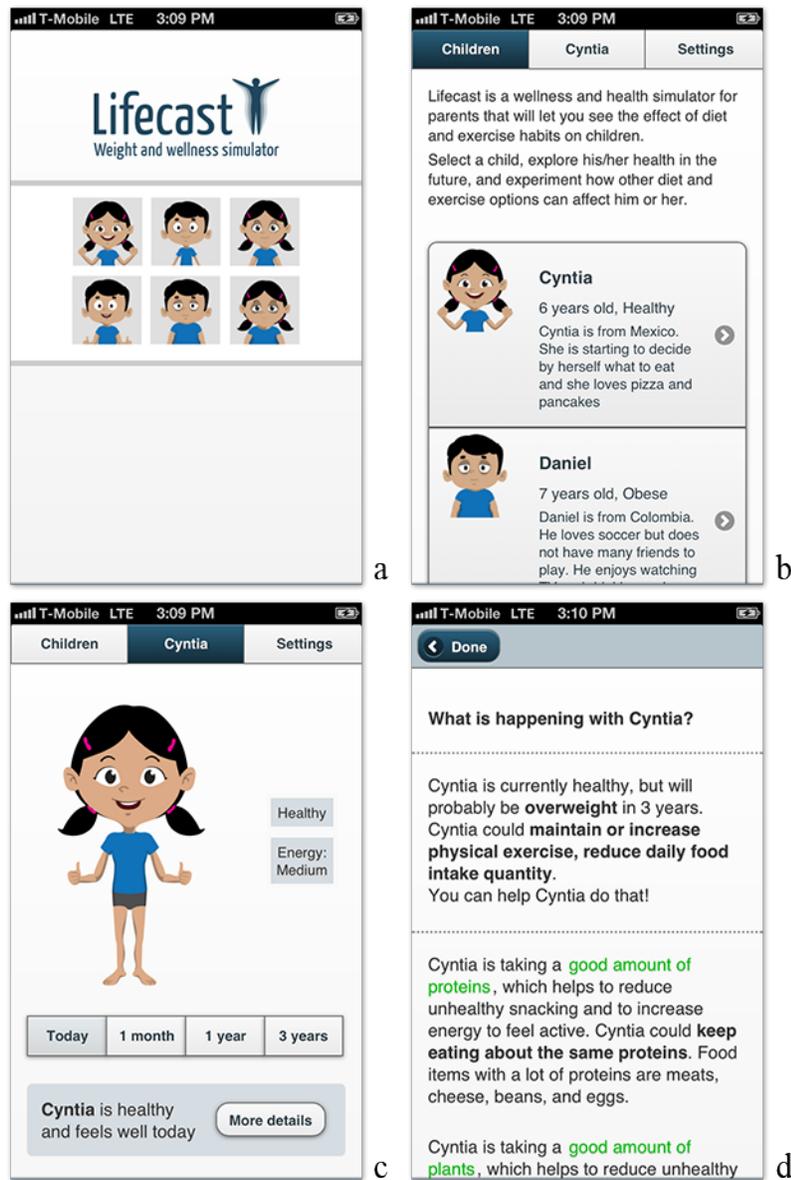


Figure 18. Screenshots of pages in comic mode of *Lifecast*.

a) introduction, b) home, c) child, and d) information.

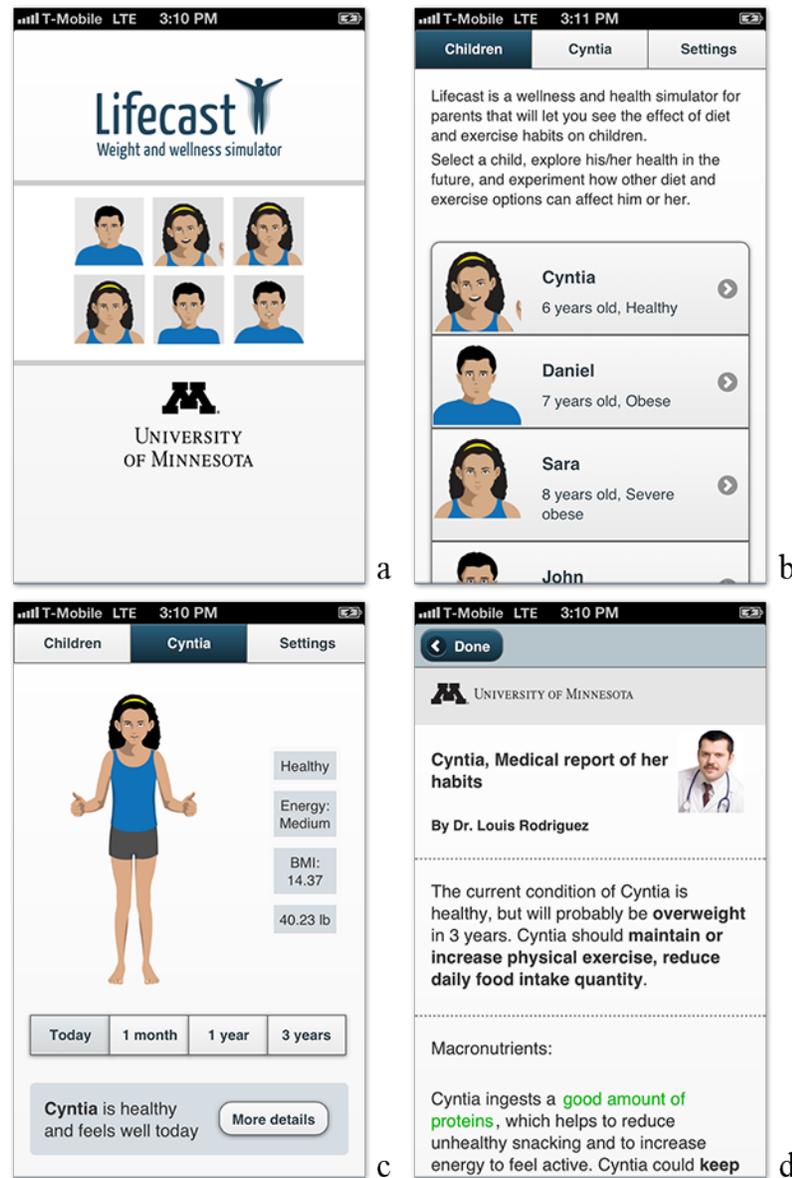


Figure 19. Screenshots of pages in realistic mode of *Lifecast*.

a) introduction, b) home, c) child, and d) information.

and the format were the same for all the rhetorical modes of the application. In all modes there are consistent visual elements such as the *Lifecast* logo, copyright information, the

interactive options and images for habits, and the settings page. The core content is also the same. Table 2 shows a comparison of differences across the three modes.

Table 2.

Differences among the Three Rhetorical Modes in the Lifecast Application

Page	Infographic	Comic	Realistic
Introduction	- Sequence of four images with weight progression .	- Children's faces in comic style.	- Children's faces in realistic style. - University of Minnesota logo .
Home (Children list)	- Children's faces in infographic style.	- Children's faces in comic style. - Fictional short stories of children.	- Children's character faces in realistic style.
Child (prediction and habits)	- Children's body in infographic style. - Information display with condition, energy level, BMI, weight, height, and age .	- Children's body in comic style. - Information display with condition and energy level . - Facial expressions and traits in non-healthy conditions are exaggerated in this mode.	- Children's body in realistic style. - Information display with condition, energy level, BMI, and weight .
Information (more details)	- Textual report in simplified style (bullets and tables).	- Textual report in informal style (narrative).	- Textual report in medical style (physician report). - Physician image. - University of Minnesota logo .

For the infographic mode, which was expected to have a reduced number of pathos and ethos indices, the concept was to create rational text and visuals that

resembled scientific simulations through the use of visual simplicity, statistics, and information visualization styles. The list of children characters was presented with the necessary information only. The body image was simplified and abstracted. Gestures of energy level in the child page were reduced to expressions in the mouth. All technical information about the children was given (i.e., condition, energy level, BMI, weight, height, and age.) And the information page was presented as a technical simplified report using bullets and tables.

For the comic mode, which was expected to have increased number of pathos indices, the concept was to center on the parents' confidence and feeling that they could help the children. The goal was to reduce anxiety and create sympathy with the characters, but also link the overweight condition with emotions of shame. The list of children characters was presented adding personal fictional stories of the children characters. The body image was abstracted using cartoon style. Facial expressions and traits in overweight conditions were exaggerated, including eye circles. Gestures of energy level included representation of mood in hands and face. Technical information was simplified to avoid focus on rational understanding (e.g., only information on condition and energy level was provided). And the information page was presented as an informal style using a narrative.

For the realistic mode, which was expected to have increased number of ethos indices, the concept was to center on credibility of the information. The goal was to present the content accurately and supported by branding. The University of Minnesota

logo was added in the introduction and information pages. The list of children characters was presented with the necessary information only. The body image was shown with realistic graphics. Gestures of energy level included representation of mood in hands and face. Technical information relevant in health care services was presented (e.g., condition, energy level, BMI, and weight). And the information page was presented as a medical report presented by a physician.

Software development

Since the intention was to create an application compatible with as many mobile devices as possible, a mobile web application was created based on HyperText Markup Language version 5 (HTML 5). This language is a standard for applications distributed on mobile Internet browsers. A framework for interface development based on HTML 5 called jQuery Mobile was also used. jQuery Mobile is a touch-optimized library to create applications in a single page, which aims to reduce development time, endure compatibility across devices, and optimize navigation speed.

JavaScript embedded in HTML 5 was used to perform dynamic functions, run the prediction algorithm, and save data in the client devices. Cascading Style Sheets version 3 (CSS 3) embedded in HTML 5 was used to refine the layout of objects that are not part of the jQuery Mobile framework. Last, CreateJS was used in the character graphics in the child page. CreateJS is a library to manipulate vector drawings as a HTML 5 Canvas element and JavaScript. The artwork was created in Adobe Illustrator, migrated to Adobe

Flash, and exported as JavaScript using the Flash Toolkit for CreateJS.

Second session of user research

As described in the previous chapter, six Latino parents participated in the second session of user research with an interview about habits and a usability test. The data analysis from the interview provided confirmatory information about the design decisions about diet and exercise content. The data from usability tests provided insight to refine the interactive design of *Lifecast*. The researcher-designer found that the habit patterns of the participants' families were similar to those found on the first session of user research. Regarding the usability testing, the participants performed five tasks using a high-fidelity digital prototype (see Figure 20). Task one was "Select a child character and see what is his or her condition in 1 and 3 years." All of the participants were successful in selecting a character, but three of them failed to select the correct conditions and one used the energy value. One of the reasons for this error is that they were confused by the word *condition*.

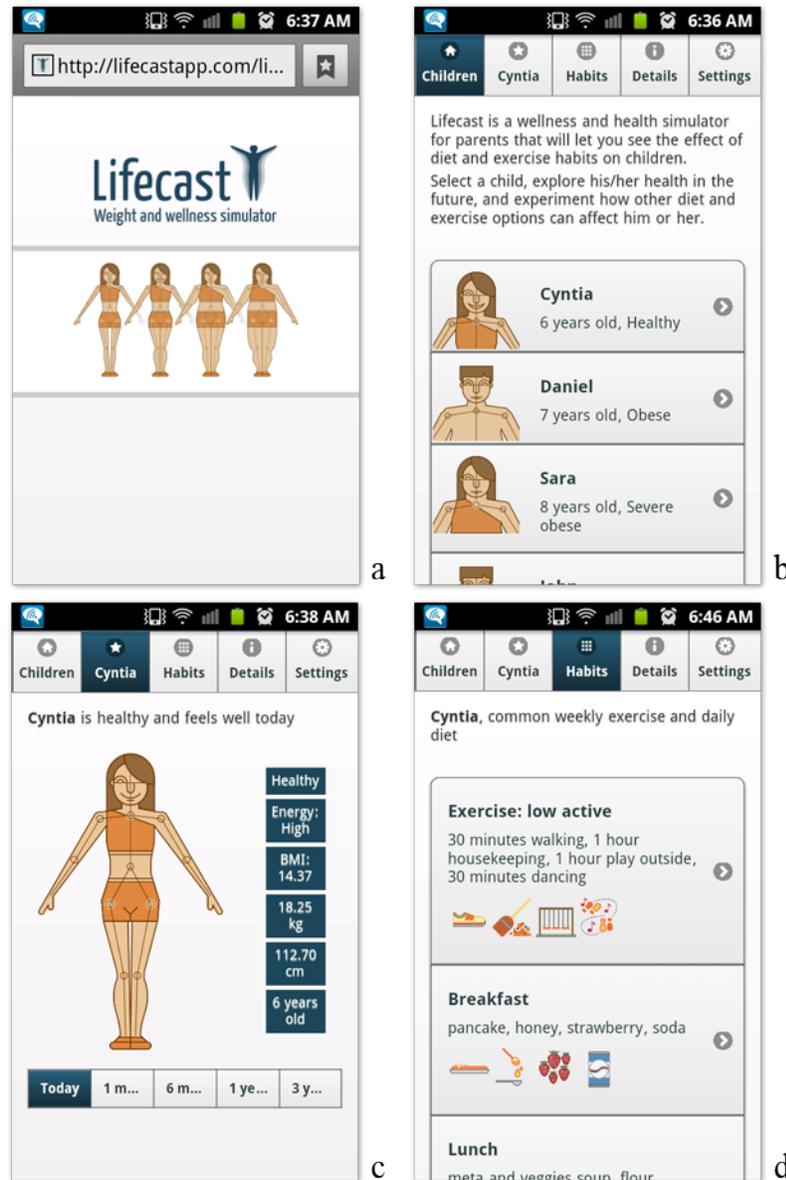


Figure 20. High-fidelity digital prototype of *Lifecast* used in second session of user research.

The second task was “Change the child character’s exercise and see how that affects his or her condition in 3 years.” The third task was the same but asked to change

the child character's common lunch meal. These tasks were not achieved correctly for any participant. Although the majority of them actually changed exercise and meal habits, no one wrote down the correct answer. The observation and later debriefing showed that the participants did not understand that the application could provide the answers. They thought that app was a passive source of information rather than an interactive tool. Additionally, the task wording was not clear for them.

The fourth task was "Find details about what the child character should do regarding the proteins." Only one participant completed this task. The main reason for failure was the lack of understanding of what the app could do. Additionally, no participant fully understood the concept of protein in food.

The fifth task was "Select another child character." Five participants completed this task. At this point they were familiar with the page structure and knew where to select another character.

This usability test showed that navigation and information elements had good visibility and clarity. Although there were more failures than expected, the application needed few corrections to be ready for the evaluation in the following stage. The interactive design was adjusted and some details of the visual interface were refined. The major change was to merge the habits page into the *Lifecast* page. The information page was not changed, but its access path changed from a button called 'details' in the top menu to a button called 'more details' inside the content of the *Lifecast* page. The goal of these changes is to reduce the usability issues presented in the test.

Regarding the rhetorical modes, the second usability test showed limited results in difference of preference. The limited time that the application was used explains in part why there is no sufficient data. Additionally, first-time users tend to focus their attention on navigation and tasks, not on the information presented in the content. All of the participants were motivated to use the application more, which suggests that in later uses they might focus on learning from the content.

4. Findings

As discussed in previous chapters, this dissertation examines rhetorical elements on design products for social change. It focuses on understanding the rhetorical appeals (logos, pathos, ethos) in graphic design products that positively change knowledge, attitudes, and behavior of people. The ultimate aim of this research is to generate design knowledge and principles that help to create more “useful, usable, and desirable” (Buchanan, 2001, p. 13) design products for social change.

Following is the discussion of the results from the project. Section 4.1 comprises the findings from the analysis of rhetorical appeals in graphic design products for social change (i.e., four animated viral videos). The analysis included a rhetorical appeals analysis, a review of online views, and expert interviews. Section 4.2 is a report of findings of the auto-observation of the researcher-designer’s behavior incorporating rhetorical appeals in a design process. The observation focused on how design decisions were made regarding the configuration of rhetorical appeals during the design of a design product for social change (i.e., the mobile web application *Lifecast*) (For further description of the design product, see section 3.4). Last, section 4.3 consists of the findings of the evaluation of the efficacy of a design product for social change (i.e., *Lifecast*) and the analysis of its rhetorical appeals. The evaluation included a design-experts evaluation and a real-context evaluation.

4.1. Stage 1. Analysis of design products

This section describes the findings of the analysis of four animated viral videos. The purpose of this stage was to analyze the rhetorical appeals in existing successful design products and assess how they change the knowledge, attitudes, and behaviors of audience. The analysis includes a rhetorical appeals analysis, a review of online views, and expert interviews. There are four different videos and each one has its own intended audience. However, all of them target the middle class population, aim to modify public opinion, and promote community action.

Rhetorical appeals analysis

The purpose of the rhetorical appeals analysis was to understand how successful graphic design products for social change (i.e., animated viral videos) use configurations of rhetorical appeals. The four videos include the following.

- *The Story of Stuff* (The Story of Stuff Project, 2007) (hereafter referred to as *Story of Stuff*).
- *Naomi Klein's Thought Bubble: Ethical Oil?* (Smart Bubble Society Inc., 2011) (*Ethical Oil*).
- *RSA Animate - The Crisis of Capitalism* (Royal Society for the Encouragement of Arts, Manufactures and Commerce, RSA, 2010) (*Crisis of Capitalism*).

- *PROTECT IP / SOPA Breaks the Internet* (Fight for the Future, 2011) (*PROTECT IP*).

For the rhetorical appeals analysis, the researcher identified indices of logical arguments (appeals to logos), emotion (pathos), and credibility (ethos). This subsection presents key findings obtained. They are organized as salient indices of the appeals that emerged from the analysis. The salient indices of appeals to logos emerged from the analysis of elements that facilitate cognitive perception and have a logic structure. The salient indices of appeals to pathos emerged from the analysis of elements that grab attention by creating attraction or repulsion. The salient indices of appeals to ethos emerged from the analysis of elements that persuade by the projection of the characters. After the description of the salient indices, a general review of the use of the rhetorical appeals in the videos is described.

Salient indices of appeals to logos

The researcher identified the following salient indices of appeals to logos: visual simplicity and repetition, simple rational metaphors (shape, lines, direction), audio-visual consistency, symbols that are appropriate for the audiences, rational narrative style (e.g., documentary or lecture), use of evidence (facts, historical data), and clear directions for action.

Simplicity: All four videos aim for simplicity. Whereas the videos of *Story of Stuff*, *Ethical Oil*, and *PROTECT IP* use simplicity to overview the topic and redundant visual elements to increase understanding, *Crisis of Capitalism* has more complex

information because lecture and animated drawings have variations in content. This complexity may be due to the visual communication being created after the lecture, and the lecturer was not part of the planning of the visual information.

Simple rational metaphors: *Story of Stuff* relies on simple visual metaphors (i.e., linear versus circular and black versus green) to express the difference between irresponsible consumption and sustainability. Relative size is used to express the power of citizens, government, and corporations. There is a conflicting representation in the circular shape: not only is it used to represent sustainability, but it is also used to represent the vicious circle of work-media-unhappiness consumption. *PROTECT IP* uses a world globe depicting Internet connections, but it is not central part of the visual speech. The other two videos rely little on rational metaphors.

Audio-visual consistency: All videos except *Crisis of Capitalism* have a planned and adequate audio-visual synchronization and use written words to reinforce key concepts. *Crisis of Capitalism* uses longer written fragments in addition to drawings. It uses two verbal stimuli: the viewer has to listen to the audio lecture and to read the written words in the visualization. This duality causes difficulties for verbal cognitive processing widely proven by the theory of multimedia learning (Mayer, 2001). Additionally, timing is sometimes too fast or too slow, which is a consequence of production of the video after recording of the lecture.

Symbols: All videos use symbols that seem to be appropriate for their audiences. *Story of Stuff* and *Ethical Oil* use common Western symbols. *Crisis of Capitalism*

symbols have a higher level of complexity and may not be understood by people without history and politics knowledge; for example, animal pigs represent PIIGS European countries (Portugal, Italy, Ireland, Greece, and Spain) and *PROTECT IP* uses symbols that are familiar to tech-literates, such as arcade game elements.

Narrative style: *Story of Stuff* and *PROTECT IP* have a documentary style explaining the issues and developing composite arguments to posit their claims. *Ethical Oil* also has documentary style but is a short exposition of critical concepts of the issue. And *Crisis of Capitalism* is an academic lecture with animated drawings.

Use of evidence: *Story of Stuff* uses several facts to support the arguments. The facts add legitimacy to a very informal visual style. *Ethical Oil* only uses a fact about Canada's carbon emissions; evidence is very minimal, and therefore, not persuasive. Evidence in *Crisis of Capitalism* and *PROTECT IP* is based on historical information, but it is presented in a subjective tone. The *PROTECT IP* audience may be familiar with the historical information presented and perceive it objectively.

Directions for action: None of the videos contain a detailed recommendation for action. *Story of Stuff* and *PROTECT IP* mention how to act on their issues and have links at the end to take actions. *Ethical Oil* has a general attitudinal claim and is unclear how audience is recommended to react to the issue. In *Crisis of Capitalism* the lecturer, after claiming there is a problem, explicitly says that he does not know the answer.

Salient indices of appeals to pathos

The research identified the following salient indices of appeals to pathos: emotional elements (e.g., playfulness, danger, humor, fear), emotional metaphors (positive or negative), ethical content to elicit negative emotions (e.g., disrespect, irresponsibility, abuse of power), reception comfort (or friction), and audience sensitive content (e.g., disturbance, risk, contamination, oppression, privacy loss)

Emotional elements: *Story of Stuff* is based on graphic elements that are playful and uses negative elements such as the unhappiness vicious circle or aggressive contaminants. At the end the messages, hope is used to motivate action. Danger is used in *Ethical Oil* to appeal to emotions, which is reinforced by speed to show urgency. *Crisis of Capitalism*'s primary emotional element is humor, which sometimes overwhelms the content. Humor can grab attention but can also disconnect the audience from the main message due to the timing difference between the lecture and the visual information. In *Protect IP*, there are playful elements based on the arcade game metaphor but fear of potential loss of freedom on the Internet is the core emotion.

Emotional metaphors: *Story of Stuff* uses several emotional metaphors, such as (a) the powerless look of the animated characters versus fat government and corporations and (b) a washing machine to represent an old and unfashionable computer. *Ethical Oil* relies on a major emotional metaphor, which is the use of black arteries to represent the negative impact of the oil industry in the heart of society. In *Crisis of Capitalism* a *Monopoly* game board is used to develop the historical arguments about the capitalist

economy. There are also several humorous metaphors throughout the video. Finally, *PROTECT IP* uses a positively remembered classic arcade game, *Space Invaders* (1978), to illustrate how corporations may attack private content, and subsequently censor independent content, creativity, and innovation.

Ethical content: In all the videos, much of the content has ethical implications and connections that are intended to elicit emotionally negative reactions. *Story of Stuff* has an ethical element that stands out, which is the subordination of the government to the large corporations. In one scene the government's persona cleans the shoe of the corporation's persona. Another ethical element is the lack of responsibility with the Third World, with actions such as sending waste there and making people unsafely recycle dangerous products. In *Ethical Oil*, oil companies are depicted as unethical; and in *Crisis of Capitalism*, oppressors' greed is a significant cause of the crisis. In *Protect IP*, historical abuse of censorship is presented as an argument to reject the bill. Since all the videos are about complex social problems, ethical situations could be pervasive and used often in the arguments.

Reception comfort: This element refers to the perceptual and emotional friction or comfort experienced by the audience when receiving the communication. *Story of Stuff* begins with a calm narrative and progresses into alarming issues, though the comic graphic style and informal appearance of the presenter lightens the reception difficulties. *Ethical Oil*, in contrast, aims from the beginning to distress the audience. *PROTECT IP* falls in between these two with worrisome content but serene narrative. *Crisis of*

Capitalism has a challenging verbal and visual content that is balanced with humor and comic-like drawing style.

Audience sensitive content: This element refers to content that may be disturbing or tension-producing for some audiences. *Story of Stuff* uses statistics about happiness studies to contend the crisis of the system. It also shows the health risk posed to babies by contaminated breast milk or the health risk of industrial poison exposure to women of reproductive age. *Ethical Oil* depicts a potential broad contamination of the environment and ineffective environmentally responsible behaviors of Canadians due to the stronger negative impact of sand oil. In *Crisis of Capitalism*, the issues are seen as a challenge for world leaders; yet graphics divides people into greedy dominators versus oppressed workers with low wages. *PROTECT IP* warns that even general users can lose personal content, such as YouTube videos, if they naively use copyrighted content.

Salient indices of appeals to ethos

The researcher identified the following salient indices of appeals to ethos in the videos: political neutrality (objectivity), peer-level visual style (e.g., non-corporate, documentary), narrator appearance (to cause rapport), narrator profile (presentation of the character), narrator tone (e.g., passion, confidence, calmness, empathy), and presentation of supporting organization.

Neutrality: All the selected videos have a liberal discourse. *Ethical Oil* is the most aggressive and *Crisis of Capitalism* has a sharp claim at the end. *Story of Stuff* and *PROTECT IP* are also clearly liberal and anti-corporate power but their tone is more

moderate. Additionally, the visuals support political neutrality or positions. *Story of Stuff* uses neutral visuals to avoid conflicts of race, gender, or age, which broadens the potential audience and allow focusing on the environmental message. *Ethical Oil* uses more dramatic contrast in coherence with its visual concept. *Crisis of Capitalism*'s use of humor includes depictions of stereotypes, which may lead to perceptions of subjective positions. Finally, *PROTECT IP* uses unidentified visuals of everyday Internet use situations, such as YouTube videos clips or Wikipedia entry shots.

Visual style: *Story of Stuff* has a friendly non-corporate style that gives a sense of credibility on the topic. In *Ethical Oil* aggressiveness can cause a sense of a biased view on the issue. In *Crisis of Capitalism*, humor and illustration reduce the tension of extreme liberal speech. And in *Protect IP*, documental visuals create the effect of objectivity.

Narrator appearance: *Story of Stuff* uses narrator appearance as a central element of the video. Annie Leonard is dressed informally and tries to show herself as a common citizen, which causes rapport with the audience. In *Ethical Oil*, the narrator only appears in a rough drawing in the first frames. She is an activist known by the audience. *Crisis of Capitalism* and *PROTECT IP* only use narrator voice-over.

Narrator profile: Narrators have different profiles that are known to different extents. People may or may not know the presenter. In *Story of Stuff*'s first frames, Annie Leonard mentions her experience in environmental research, which positions her authority to speak about the issue. Leonard is an urban planner and environmental expert that became famous with the *Story of Stuff* series. *Ethical Oil* begins with Naomi Klein's

name and an image of her but does not explain who she is. Klein is a journalist and social activist well known in North America and Western countries. *Crisis of Capitalism*, before the David Harvey's speech, begins with his name and drawing. Harvey is a Marxist geographer and researcher and one of the 20 most-cited theorists in the humanities (Gill, 2009). In *PROTECT IP* neither the narrator nor the producer are introduced and the video.

Narrator tone: Leonard's tone in *Story of Stuff* is passionate and urging but without anger, which helps to persuade skeptical audiences. *Ethical Oil*'s narrator, Klein, uses an angry tone that is consistent with other elements but may give sense of bias. In *Crisis of Capitalism*, Harvey has a confident scholarly tone that captures attention. Even with some angry words at the end, his authority is maintained. Ferguson's tone in *PROTECT IP* is calm but urging the need for action; this tone helps to persuade the audience to believe him.

Supporting organization: Organizations do not have a primary role in the videos. *Story of Stuff* displays in the first frames Tides Foundation as sponsor and Free Range Studies as producer, but no further information is given. *Ethical Oil* and *PROTECT IP* do not introduce any organization. Smart Bubble Society produces *Ethical Oil* and other similar videos. It is a graphic design non-profit that supports social change activism. In *Protect IP*, the supporting organization, Fight for the Future, is not presented in the video. In *Crisis of Capitalism*, the lecture series organizer and producer, Royal Society of Arts - RSA, is shown in the first frames. RSA is British-based and worldwide known

multidisciplinary institution that promotes social change. The identity of the RSA gives high credibility to the video.

General review of the use of the rhetorical appeals

The analyses of the three rhetorical appeals as present in the videos show strengths and weaknesses of each video. First, the analysis of appeals to logos shows that *Story of Stuff* utilizes a variety of rational salient indices such as simplicity, rational metaphors, and evidence; perhaps its major disadvantage is the time length. *PROTECT IP* follows that pattern but is less rigorous; it is based on historical evidence, but uses a subjective tone. It is powerful to an audience that is familiar with the historical context. *Ethical Oil* and *Crisis of Capitalism* have a moderate appeals to logos.

The analysis of appeals to pathos shows that *Ethical Oil* is the video that relies more on emotional indices, using an aggressive style and reinforcing danger. Even though *Crisis of Capitalism* is an academic lecture, the design has a significant effect on emotions because the designers recurrently use humor as a tool for engagement. Although *Story of Stuff* and *PROTECT IP* use this appeal moderately with a neutral tone, they may generate effective reactions. *Story of Stuff* presents experiences that are likely to be related to experiences of people, which generate sympathy and wonder. *PROTECT IP* reiterates fear as a tool to urge action.

Finally, the analysis of appeals to ethos shows that *Story of Stuff* and *Crisis of Capitalism* use credibility and character more effectively than the other video do. *Story of Stuff* carefully creates the argument and the narrator establishes authority in the topic

from the beginning. Although it clearly is an activist message, the calmness of the presentation provides credibility. *Crisis of Capitalism* has a character that inherits from the academic lecturer and the supporting organization, which increases the credibility. *Ethical Oil* and *PROTECT IP* have a moderate focus on this appeal.

Review of online views

The purpose of the review of online views is to estimate the impact of the animated viral videos in terms of distribution and use. Table 3 summarizes the findings of the review, listing at each video posted, the user who posted it, and the number of views, likes, dislikes, comments, and days online. The reader should note that the posts differ in many ways, limiting comparison. (1) When selecting posts of videos, the researcher selected those with more than 100,000 views, with the exception of *Ethical Oil*. Its most viewed post had far fewer views (i.e., 1,207). The video was still included in the study because of its topic and relative success. (2) In June 23, 2012, when the data was captured, the number of days each video had been online differs, ranging from a low of 157 days for a post of *PROTECT IP* to a high of 1,594 for a post of *Story of Stuff*. (3) This analysis does not account for group views, such as those done in schools or colleges. (4) This data does not include embedded interaction such as comments on the videos when they are shared in sites such as Facebook or Twitter.

Table 3.

Summary of Online Views of Animated Viral Videos

Video and Site	User	Views	Likes	Dislikes	Comments	Days online
<i>Ethical Oil</i> , YouTube	ThoughtBub bler	12,107	283	32	76	229
<i>Crisis of Capitalism</i> , YouTube	theRSAorg	1,779,869	13,634	931	7,718	726
<i>PROTECT IP</i> , Vimeo	Fight for the Future	5,100,000	7,985	NA	0	242
<i>PROTECT IP</i> , YouTube	kirby1	437,685	15,969	352	4,486	241
<i>PROTECT IP</i> , YouTube	WoodysGa merstag	115,026	7,418	174	4,031	157
<i>Story of Stuff</i> , YouTube	Psychetruth	2,273,062	19,697	3,499	13,641	1,442
<i>Story of Stuff</i> , YouTube	storyofstuffp roject	1,729,445	12,139	1,709	5,707	1,158
<i>Story of Stuff</i> in Spanish, YouTube	storyofstuffp roject	1,628,518	8,474	182	1,577	1,026
<i>Story of Stuff</i> in Spanish, YouTube	Pmaril	838,972	1,493	58	370	1,594
<i>Story of Stuff</i> in Portuguese, YouTube	jpfaraco	549,693	2,323	84	438	1,281
<i>Story of Stuff</i> Portuguese, YouTube	cerradowiki br	241,822	614	34	1	1,339

Note. Data captured on June 12, 2012.

Story of Stuff has been on air for a longer time than the other three videos and has had significant success. *PROTECT IP* also has had major success and has done it within a surprisingly short period of time. *Protect IP*'s success may be explained by the urgency and relevance of the content: the U.S. congress was discussing the bill criticized in the video in the past months and the users in the video sites (YouTube and Vimeo) would

have been directly affected by the bill. *Story of Stuff* has been viewed in Spanish and Portuguese and the video has reached a significant Latin American audience, who tend to agree more with the content (see likes/dislike proportions) than other audiences do.

Expert interviews

The purpose of the expert interviews was to pragmatically assess the potential of the animated viral videos to change the knowledge, attitudes, and behaviors of the audience. This section presents key findings obtained from four interviews that were conducted via phone call (see Appendix A for interview guides). Because there are substantial differences among the interviewees, a narrative of insights from each interview is reported without using patterns or codes.

Insights from interview with Matthew Taylor, chief director of RSA

For Mathew Taylor, the goal of RSA Animate lectures is a way to promote quality discourse in the general public and not to influence government policies or corporate decisions. He believes that humor is a key instrument to engage the audience. It is well used because the goal is to capture interest rather than present the details or simplify the content. Thus, the use of visualization for comprehension centers on general concepts. The lectures particularly use British irreverent humor, which, he added, helps with the goal of opening up ideas. Taylor argued that simplification is not the major aim, even though it would help with complex ideas. He said that the people tend to agree with

the arguments because the lectures are shared in human groups that share beliefs and have higher literacy levels, which is not representative of the general population.

Taylor's comments imply that pathos is the major appeal in the RSA videos. Even though he thinks that the animations make the content accessible, he also believes that the lectures target a highly literate audience. If his view is correct, the video influences people's political and ethical positions, but is limited for further understanding by less literate people.

Insights from interview with Kirby Ferguson, producer of PROTECT IP video

Kirby Ferguson said that the high number of views of the *PROTECT IP* video can be attributed to the NGO Fight for the Future promoting the video in online campaigns. He argued that the factors contributing to the success of the *PROTECT IP* video were its concision, aesthetic quality, and engaging narrative. The argument, he said, centered in fear appeals by explaining the potential loss of freedom on the Internet; however, it also aimed to be a logical and moderate story. Ferguson said that there was a lot of misinformation around the bill that made it challenging to help people understand the issues, but he expected that the video had helped in clarifying the confusion. He does not consider himself an activist, who has to be aggressive to defend his points.

Ferguson's responses did not give clear insights to answer the research questions. However, his remarks suggest that there is dominance of pathos appeal. Although there were multiple interpretations of the bill, the video may have helped to clarify understanding of the bill because it had a moderate narrative. Although Ferguson

responded that there is no appeal to character because the video does not show the producers, ethos is part of the rhetorical appeals because the moderate visual style, the neutral tone, and the ethical content about censorship help establish the credibility of the video.

Insights from interview with Michael O’Heaney, co-director at the Story of Stuff Project

Michael O’Heaney argued that *Story of Stuff* has had a large social impact since “anecdotal evidence is quite overwhelming” (personal communication, February 16, 2012). He believes that the videos have led to changes in people’s lifestyles. O’Heaney explained that Project is an ‘intermediary’ with the role of storytelling; they partner with advocacy organizations that are in charge of managing community actions. A concrete result is, for example, the number of petitions signed after prompted in videos like the *Story of Cosmetics* (another of the videos produced by Project). He argued that the influence is large and measurable by how their partners have actively used the videos as a resource and educational tool for their goals. However, the quantitative outcome is unknown because they did not try to systemically collect data of the outcome.

Regarding the major visual and content characteristics, O’Heaney said that language and graphic simplicity, dynamism of animation, and the storytelling quality contribute to the video’s success. Yet, he argued, there is a major characteristic: authenticity. He added that a common flaw is to try not to offend anyone. For example, when they included the sentence “you suck” in the *Story of Stuff* video, someone said that

the video would never be seen. But, it has been viral and seen in thousands of schools because teachers have shown it to their students.

O’Heaney said that there is a balance among appeals to reason, emotion, and credibility. Emotionally, the *Story of Stuff* video tackles pre-crisis adverse feelings existing about the economy. Additionally, it also uses rational arguments by presenting facts and figures. He added that the argument appeals to different people by using information within the audience’s own experiences. The diversity of appeals may also explain the series’ success in international audiences. He explained that Project does several things to reach audiences with limited literacy, such as language translation and DVD distribution; however, he thinks that the audience is likely to have high literacy.

The insights from this interview show that the *Story of Stuff* video and series have had a relevant effect, although it has not been proven scientifically. The balanced use of logos, pathos, and ethos appeals plus the quality of graphics and storytelling explain the strength of this visual communication to influence people and reach diverse audiences. Nonetheless, the effects on people with limited literacy are not clear.

Insights from interview with Edward Maibach, director of the Center for Climate Change Communication at George Mason University

Some questions in this interview make reference to content from an article that Edward Maibach and colleagues published (Maibach et al., 2008). The concepts include strategy levels for social change and types of audiences. When asked about the social

change strategy levels, he said that videos like *Story of Stuff* affect individual and social networking levels, but its effect in the community and the place levels is unknown.

Maibach argued that effective climate change communication persuades the religious right, the most difficult audience, by including arguments such as energy independency and waste reduction. Referring to a study about characteristics of *The New York Times* articles shared in social media, he said that shared content is positive and unexpected.

Regarding the rhetorical appeals, Maibach does not recommend the use of ethos, as it needs a deep understanding of people's values. Also, such appeal may be easier to reject. He added that pathos should be activated before logos since emotional information is processed faster.

For Maibach, the success of videos such as *Story of Stuff* is due to the understandable language and the visual appeal. However, he argued that this communication has a limited effect in action. He mentioned that in their research they have found that people with different attitudes about climate change have similar actions in energy reduction. He cited an article about influence and behavior change (Rothschild, 1999), which explains that there are three levels of intervention: education (and communication), marketing, and law. Communication only works in very specific circumstances. He also cited McKenzie-Mohr's (2011) views on social marketing, who proposed that removing barriers to action helps people perform sustainable behaviors.

Maibach explained that after this, communication could have the role of reminding people about the actions and their benefits.

Maibach suggested that one alternative for using communication is to clarify issues to gain public support for policy change. For example, people have the misconception that scientists do not agree with climate change, but 95 percent of scientists agree that the climate is changing. Then, communication that aids clarification of this misconception will help collective support for policy in climate change. He focuses on communication that generates collective rather than individual behavior change.

Finally, Maibach commented on communication for the developing world. He said while prevention communication is more important in the developed world, preparedness communication is more important in the developing world because the consequences of climate change are more severe in developing countries.

4.2. Stage 2. Design project and designer behavior

This section describes the research findings of stage 2. The design research activity in this stage was the auto-observation of the researcher-designer behavior in the design process, of which the outcome was a design product for social change. For a description of the design product, see section 3.4.

Observation of the designer behavior

The purpose of this auto-observation of the designer behavior was to document how design decisions were made regarding the configuration of rhetorical appeals over eight months. The data themes that emerged were rhetorical appeal process, interaction design process, health algorithm work, project management, and technical issues. The reported findings below focus on the rhetorical appeals process theme because it provides information to answer the research question: how does the designer make decisions about rhetorical appeals in the design process? The researcher-designer expected to assess how the appeals are applied and to generate recommendations or principles for design practitioners in future projects. Four major findings emerged from this activity.

Finding 1: The understanding of the rhetorical appeals changed over the design process.

At the beginning of the project and before a design concept was developed, the researcher-designer had the idea of creating three rhetorical modes. The rhetorical modes were called infographic, comic, and realistic and were based on Ehses (2008) guidelines that suggest that a graphic design product can be created with dominance of one of the appeals. The infographic mode would be logos-driven, comic mode pathos-driven, and realistic mode ethos-driven.

Figure 21 shows the process of rhetorical appeal differentiation. At the beginning, the researcher-designer expected to have a clear dominance of one appeal in each rhetorical mode. Late in the design process, he realized that clear dominance of pathos

and ethos could not be achieved because logos was the central enthymematic argument that was going to be present in all the modes. Thus, the direction shifted to having a base of appeals to logos that all modes would share and a substantial difference in the configuration of appeals to pathos and ethos. Infographic mode would have reduced pathos and ethos indices, comic would have increased pathos indices, and realistic would have increased ethos indices.

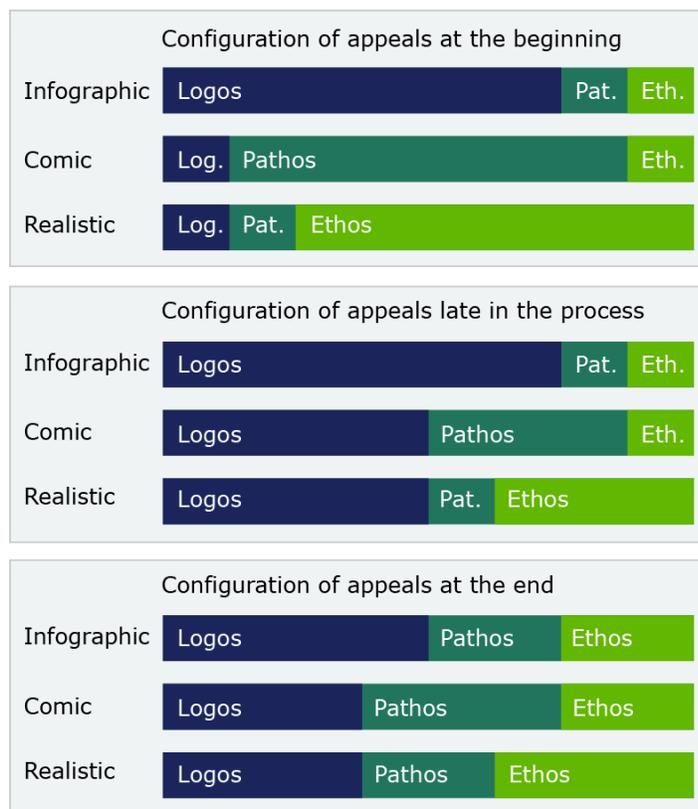


Figure 21. Rhetorical modes and perception of configuration of rhetorical appeals during the design process of *Lifecast*.

This latter understanding of the configuration of rhetorical appeals follows Braet's conclusion (Braet, 1992). He explained that using pathos or ethos as enthymematical arguments may counter the persuasion goal. An enthymeme (incomplete syllogism) is a logos argumentative option that takes the form of giving a reason and then a conclusion (Aristotle & Kennedy, 1991). Braet concluded that a logos enthymeme or argument could be effectively combined with ethos and/or pathos indices.

When the product was finished, however, the researcher-designer concluded that there was not a substantial differentiation among the appeals. The last understanding was similar to the second one and follows Braet's conclusions, but the appeals difference was unsatisfactory for the initial plan because the modes might not provide enough difference for comparative evaluation: all the modes have the same concept, interactivity, and format. For instance, the effort to make the health prediction logical and realistic, which is the central concept, strengthens the appeals to logos and ethos, which benefits all the modes.

Finding 2: Decisions about rhetorical appeals focused first on illustration, later on textual and visual elements, and did not include the design concept and the interactivity.

In the first two months, the difference among the rhetorical appeals was defined for the graphics that needed to be illustrated. An illustrator was asked to create three graphic styles for the children characters with a simple explanation of the need regarding the appeals: graphics for the infographic mode need to be in an information visualization style to show simplicity, graphics for the comic mode need to be in a cartoon style to

show parody and create sympathy, and graphics for the realistic mode need to be in a photo realistic style to create respect and credibility. The illustrator was given three mood boards with imagery of other graphics that had stylistic elements related to the modes.

Figure 22 shows the first three proposals. The illustrator took into account the direction for rhetorical modes, but reported that she did not take into account the mood boards. The infographic mode was a good direction, but the pathos and ethos modes needed improvement to produce the desired reactions in the audience. The comic mode needed to be playful, exaggerated, less abstract, less serious, and a little vulnerable, whereas the realistic mode needed to be close to photography and far from casual illustration. This illustrator created the character graphics for infographic mode and the food items icons for all modes.



Figure 22. First children character graphics proposed for the rhetorical modes of *Lifecast*: infographic, comic, and realistic.

In the middle of the process and before starting to work with a second illustrator for the other two modes, the researcher-designer recognized that the design concept and the interactivity could have contributed to strengthen the difference among the three rhetorical modes. However, the scope of the project did not allow incorporating more than one interactive development. Due to the limitation, the process was continued and the second illustrator was given direction to create character graphics for comic and realistic modes.

Creating illustrations for the realistic mode was straightforward because the researcher-designer was able to communicate the goal clearly and the high degree of realism was a concrete concept. Figure 23 shows three drawings of the illustration process for the realistic mode. The illustrator followed the directions from the designer-researcher and adjustments were primarily about proportions.

Creating illustrations for the comic mode was also straightforward because the researcher-designer and the illustrator had developed efficient communication; nonetheless, it brought up decisions about dual concepts. According to Aristotle (1991), emotions are either positive or negative: calmness/anger, friendliness/hostility, confidence/fear, and shamelessness/shame. The researcher-designer wanted to use positive moods but was also interested in the potential of fear to generate change. However, the team of collaborators including the health center staff recommended using confidence instead of fear. Figure 24 shows three drawings of the illustration process for the comic mode. The first proposal had a mix of realistic and cartoon styles. The

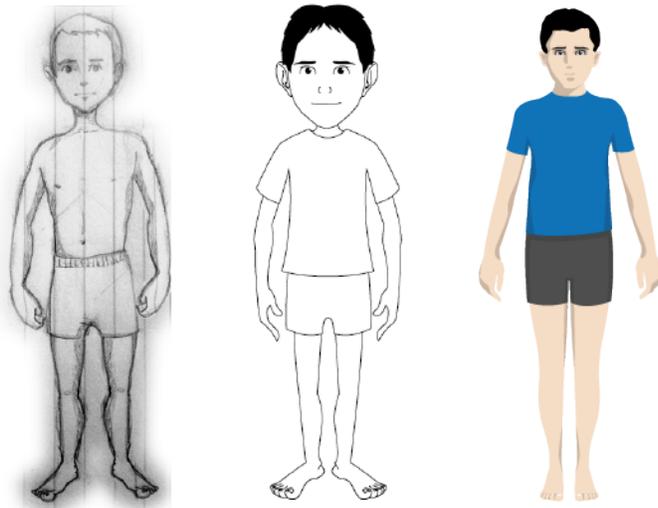


Figure 23. Three drawings of the illustration process for the realistic mode of *Lifecast*.

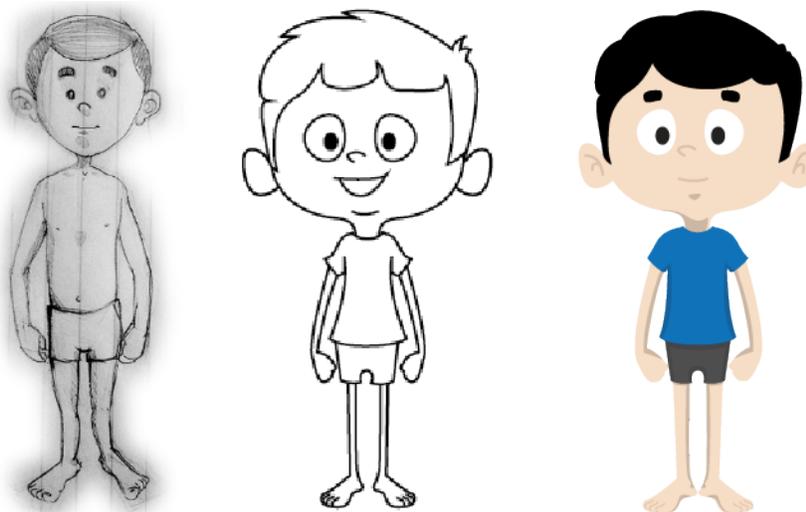


Figure 24. Three drawings of the illustration process for the comic mode of *Lifecast*.

illustrator was asked to focus on a cartoon style.

After giving the directions to the second illustrator, the researcher-designer defined other differences among the rhetorical modes. The items that were to vary from mode to mode included the following (also shown in Table 2 in section 3.4): graphics on the introduction page, graphics on the home page, and items regarding health information on the child page (specifically, six items in logos, four in ethos, and two in pathos). Additionally, comic mode was to have personal stories in the character list of the home page, and exaggerated expressions in the non-healthy character graphics. And realistic mode was to have the University of Minnesota logo in the introduction and information pages and a physician picture on the information page.

The researcher-designer decided to review again Aristotle's text (Aristotle & Kennedy, 1991), especially the content related to pathos and ethos. At this point in the process, the first session of user research was done and the graphics for realistic mode were completed. In comic mode, in which the graphics were intended to have many pathos indices, he reconfirmed the direction towards positive emotions, except for shame. It was decided to include in the gestures for non-healthy children of the comic mode a subtle relation with shame in the facial trait (e.g., eye circles). The goal with this trait was to counter the belief in Latino culture that an overweight child is healthy. The review also made the researcher-designer think that the realistic mode, that had incorporated hand gestures similarly to the comic mode, could produce substantial appeals to pathos. But any further changes could not be done because the graphics for realistic mode were

completed.

At the end of the process, the differences among modes on the information page were defined. Logos mode had a simplified style, pathos an informal narrative style, and ethos had a medical style like a physician report.

Finding 3: Project execution demands rapid definition of the project plan in terms of conceptual design, interactivity, and rhetorical appeals strategies.

The initial step to design the *Lifecast* application was to define a rough idea, which included a concept, a model of interactivity and a strategy of rhetorical appeals. Then, the project execution started and the researcher-designer was overwhelmed with project management activities such as controlling the timeline, defining the team of collaborators (e.g., HCMC staff, illustrators, engineer), giving directions to collaborators, meeting with collaborators, coordinating the user research activities, and recruiting participants.

Project management activities may seem like simple tasks, but they require having a clear direction and are time-consuming. For example, giving and communicating instructions to the illustrators and *engineer*, for them to understand what is the desired outcome, was very challenging. Also, it was necessary to constantly review the progress they made to avoid wasting time with undesired outcomes. Ensuring effective communication takes a lot of iterations and feedback. Additionally, some steps that depend on others may cause delays. For example, the researcher had to request IRB approval in both the health center and the University of Minnesota because each

institution requires its own protocol; the approval in the health center took two months. This issue ultimately caused delays in the first session of user research; though, this delay was beneficial in terms of having a clearer interactive design and health content before the start of the software development.

Other activities, such as defining the health content and coordinating the software development, demanded significant time. For the health content, the researcher-designer had to review dense documentation about nutrition guidelines for children to be able to negotiate decisions with the dietician in the health center that supported the project. For the software development, the researcher-designer had to update complex knowledge about state-of-the-art mobile applications to be able to collaborate with the engineer and ensure compatibility of the application across devices.

Additionally, complex technical issues may negatively affect the desired outcome. The software development framework, called jQuery Mobile, was chosen because it allowed creating cross-platform applications. Also, the libraries used to load dynamic graphics, called CreateJS, were chosen because they allowed manipulating vector graphics within HTML5 code. One example of a complication was that one strategy for the rhetorical modes was to have a different color palette in the interface elements, but jQuery Mobile caused a conflict with that. Another strategy was to have different colors in the skin, hair, and clothes of the children characters, which would have increased the appeals to ethos in the realistic mode. However, CreateJS library made that extremely difficult and would have required unpractical increment of file size. Then, the researcher-

designer gave up these strategies.

For these reasons, before starting the project execution, it is necessary to clearly define the project plan in terms of conceptual design, interactivity, and rhetorical appeals strategies. In the *Lifecast* design process, the project management activities led the researcher-designer to limit making conceptual decisions because the collaborators needed a clear idea of the desired outcome. Additionally, technical limitations reduced the ability to incorporate all the planned strategies.

4.3. Stage 3. Evaluation of a design product

This section describes the findings of the evaluation of the efficacy of a design product and the analysis of its rhetorical appeals. The mobile web application called *Lifecast* is about childhood obesity prevention for Latino parents. The purpose of this last stage was (a) to examine and evaluate the efficacy of the design product in terms of motivating use and changing health knowledge, attitudes, and behavior and (b) to assess how the rhetorical appeals are configured in the design product. The evaluation included a design-experts evaluation and a real-context evaluation.

Design-experts evaluation

The purpose of the design-experts evaluation was to assess the presence of the rhetorical appeals in the rhetorical modes of the design product (i.e., mobile web

application): the quality of the rational argument (logos), the presence of emotional indices (pathos), and the presence of credibility indices (ethos). This section presents key findings obtained from heuristic evaluations done by two design experts (see Appendix B for the expert evaluation form).

One expert was Hanno Ehses, retired professor from the Nova Scotia College of Art and Design. He has published several handbooks about design and rhetoric for college level learning (e.g., Ehses, 2008). And the other was Jessica Barnes, professor of visual communication design at Kent State University. She completed her M.F.A. in design with a minor in writing studies (rhetoric and scientific/technical communication) at the University of Minnesota.

Table 4 shows a summary of answers of the design experts about how they think each rhetorical mode will appeal to logos, pathos, and ethos. The criterion was a list of rhetorical heuristics of each appeal. The answers vary, but both experts seem to agree in their opinion.

To understand these answers the researcher converted the data into a simple visualization (see Figure 25). The researcher calculated averages of responses to create the visualization. The goal was to show how the design experts assessed collectively the appeals in each mode. The figure shows that the experts judged that the most appealing mode to logos is the infographic (strongly agree), then the realistic (somewhat agree), and last comic (mildly agree). The figure also shows that the experts considered that the most appealing mode to pathos is the comic (somewhat agree), then the realistic (very mildly

Table 4.

Summary of Answers of Design Experts to Rhetorical Heuristics (E are answers by Ehses and B are answers by Barness)

		Strongly agree	Somewhat agree	Neutral	Somewhat disagree	Strongly disagree
<i>Logos:</i>						
Verbal and visual information in this mode clearly present the content	Infographic	E B				
	Comic	E	B			
	Realistic	E	B			
Verbal and visual information in this mode is sufficient and complete	Infographic	E	B			
	Comic		B		E	
	Realistic	E	B			
This mode allows logical understanding	Infographic	E B				
	Comic		B		E	
	Realistic		B	E		
<i>Pathos:</i>						
Verbal and visual information in this mode is friendly and empathetic	Infographic				B	E
	Comic		B	E		
	Realistic	B	E			
Verbal and visual information in this mode help to create confidence in the user	Infographic			E B		
	Comic	B	E			
	Realistic	E B				
Verbal and visual information in this mode show that non-healthy conditions are shameful	Infographic			E B		
	Comic		E B			
	Realistic		B	E		
This mode makes the user feel that he or she is helping the characters and being kind	Infographic				B	E
	Comic	B	E			
	Realistic	E B				
<i>Ethos:</i>						
Verbal and visual information in this mode reinforce credibility	Infographic	E B				
	Comic		B		E	
	Realistic		E B			
Verbal and visual information in this mode show accuracy of the content and simulation	Infographic	B		E		
	Comic		E B			
	Realistic	E B				
This mode shows that the users' culture was considered	Infographic			E	B	
	Comic		E B			
	Realistic	E	B			

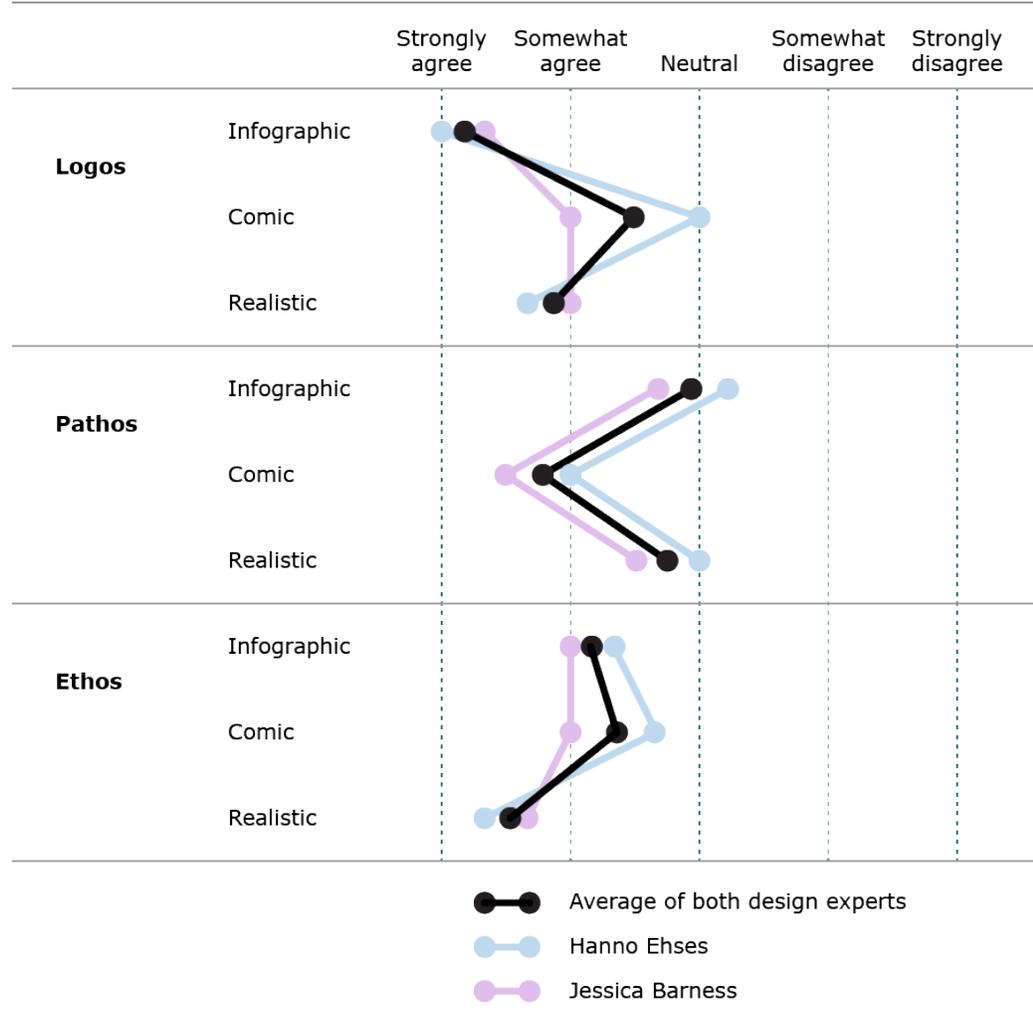


Figure 25. Visualization of design expert answers.

agree) and last the infographic (about neutral). Finally, the figure shows that the experts considered the most appealing mode to ethos is the realistic (agree), then the infographic (somewhat agree), and last the comic (mildly agree). This visualization shows that both design experts have a similar perception of the appeals. They also tend to agree with the designer-researcher.

Each design expert also had the option to write additional comments about the rhetorical appeals in the evaluation materials. Ehses did not comment, but Barnes did. For her, all modes appeal to logos. She said that the comic mode has stronger appeal to pathos for the Latino audience. She reported to have lived in a Latino neighborhood and said that the exaggeration and playfulness is associated with the media communication style of the neighborhood. Finally, she affirmed that the realistic mode appeals to ethos because it has a “clinical” style.

Real-context evaluation

The purpose of the real-context evaluation was to assess the efficacy of the design product (i.e., mobile web application) on its ability to positively change knowledge, attitudes, and behaviors in Latino parents and to assess how the rhetorical appeals are configured in the design product. This section presents key findings obtained from sessions with nine parents. Each parent was observed using the application and interviewed in two occasions: one interview was conducted before using the application and one was conducted after using the application. In the report of findings below, real names of participants are kept anonymous and pseudonyms are used.

Both sessions with six of the parents were conducted in their homes, both sessions with two of the parents were conducted at Hennepin County Medical Center at the Pediatrics Department, and, for one parent, one session was conducted at home with the other session at the Center. The houses visited were located in low-income

neighborhoods. Some of the parents' children were present for part or all of the sessions. Sometimes second grade consanguinity relatives were also in the same room — for example, Hilda's son-in-law or Rita's niece. In the health center, the sessions were conducted in meeting rooms. Two parents took one of their children and one took a friend with them to be in the session.

In the first session, the researcher collected demographic data and administered a functional health literacy test. Seven parents were from Mexico and two from Ecuador. They have between 2 and 5 children (3.33 average) and at least one 6 to 12 years old. They have been living in the United States between 9 and 25 years (15 average) and completed between 2 and 12 years of school (7 average). Seven parents owned a mobile device. Two used one owned by their children. Last, six parents had adequate level of functional health literacy and three showed inadequate level, measured with the short version of the Test of Functional Health Literacy (Baker et al., 1999).

For the analysis of qualitative data from observations, notes, and interviews, the data themes were categorized before the coding. These themes were based on the research questions and the theoretical framework: functional health literacy; health knowledge, attitudes, and behaviors before using the design product; changes in health knowledge, attitudes, and behaviors after using the design product; experience using the design product; and rhetorical appeals in the design product. Ten major findings emerged from this activity. They are grouped by theme, of which there are four. The first finding belongs to the theme of functional health literacy.

Finding 1: All parents are able to use the health care system largely because they have access to translations services (in Spanish), either formal or informal.

To see that all parents are able to use the health care system was not surprising because they have lived in the United States for many years. They had difficulties at the beginning, but they currently navigate the system with sufficient skills. Part of their ability is explained by the use of translation services. Six of them regularly use interpreters. Marco said, “Now it is much better. Now you have an interpreter and some doctors speak Spanish.” Mirta had a similar opinion, “When I arrived, it was hard because there was no interpreters. Today is easy. There is rapid attention and there is help.”

Some parents also receive or have received help from family members. Abi, for example relies on her husband: “My husband is citizen and he works. The [health] insurance is from the government. He does that.” She added, “Sometimes the leaflets are in Spanish, otherwise my husband translates them for me.” Veronica said, “Yes, I got [health care services] through help from family members that lived here.”

The next four findings belong to the theme of health knowledge, attitudes, and behaviors before using the design product.

Finding 2: The majority of parents (8 of 9) had basic knowledge about healthy habits; although, some of them (3 of 9) showed confusion with some concepts. One parent showed confusion with many health-related habits concepts.

Parents were asked to briefly describe the habits of their children regarding

exercise and diet. Then, they were asked to assess whether such habits are healthy.

Parents' answers showed that they have sufficient knowledge that is sometimes acquired from medical directions. All of the parents understand that exercising is healthy for their children. Rita said, "They have exercise class [at school] twice a week, but they are short. Then, it is not enough. The boy worked out more before, but now he is lazy. But I take him to the gym." Another parent, Inés, said, "I am not worry about the boy, but about the older girl because she tend to gain weight. I'd like to put her in a sport."

Parents also know that consumption of fruits and vegetables is healthy. When I asked Alicia what she would change she said, "More vegetables. I know she needs more." Marco talked about fruits as alternative: "We try not to give him soda, better homemade fruit juice." However, some parents find this need daunting because children do not like vegetables. Soup seems to be their strategy. Olivia explained, "He does not like vegetables, I fight [...] I put [them] in the soup." Mirta said, "When they are home, I make a soup or rice with vegetables. Though they don't like it. I try to give them lean meat, chicken. They don't like it much but they eat it. I'm begging."

Regarding processed foods, parents believe that fast foods and packed snacks are not healthy. Marco said, "There is always a moment in which he is getting cake, chocolate, chips and so. I don't like that." Another parent said,

They don't like soup unless it is a cup soup [instant soup]. But I don't like to buy cup soups because they would get it all the time. I control that [...] I don't like to buy pizza because it has too much, much calories and fat. I buy it once a month or every 3 months. I used to buy *McDonalds* once a week. I stopped. (Rita)

However, parents seem to have an ambiguous understanding of what is not healthy and why. This is not surprising because the concepts of highly processed and whole foods are complex. For example, Alicia said, “A burger does not have vitamins, maybe the protein.”

Some parents talked about the negative effects of screen time, though probably more parents would have voiced similar thoughts had the researcher asked a direct question on this topic during the interviews. Olivia said, “At home they just watch TV and then go to bed. I don’t like that.” Rita also talked about the challenge to control the screen time, “My mother is at home but they get home by 2:30 and until 4:30 they are basically watching TV and it is hard to control that. When I am at home, I have more control.”

Even though the majority of parents have basic healthy knowledge and beliefs, some parents had confusions. Particularly, two parents thought that there is not a link between habits and how energetic their children feel. Olivia said, “[The boy’s habits do] not matter. He is always the same [...] he jumps around all the time.” Abi was not sure about how much food she should serve to their children, “Sometimes yes, sometimes not [...] I feel bad when they ask for more and not to give them.”

Last, one parent, Hilda, showed greater confusions. She was not sure how diet and exercise affect the energy of their children. Also, she was not sure if vegetables were a healthy food. When she was asked if her description of their children diet was healthy, she said, “The truth, I don’t know.”

Finding 3: The majority of parents (7 of 9) reported strategies that create healthy habits in their children.

The majority of the parents take their children to exercise or exercise with them. This active involvement may be explained because they have overweight children and had received medical advice. Alicia said, “I take her to church to the scouts and plays and she runs about 2 hours [a week]. And we walk, in the mall in winter. I try to have her walk 30 minutes a day.” Marco’s wife said that they take their son to the gym and remarked, “Dad goes out with him to play soccer. He takes him out to play.” Two parents explained their strategies:

I have membership in LA Fitness. So, I take my son with me because he has high overweight. With my daughter, it complicated for me. In summer I kept her playing soccer but this year I did not find a spot for her. So in the weekends I focus on her and go to the park. They go to the park with the dogs, I have two pets, then, she is running with them Saturday and Sunday. (Rita)

I work in the nights, I am sleepy in the afternoons, but I make an effort and take them to walk. I say the day is nice and invite them to go out. That’s my way to motivate them. (Inés)

Parents also have creative strategies to provide healthy foods to their children. Two parents said that they put the vegetables in the soup and one parent adds vegetables to the rice. Mirta said, “In the rice, I put beans and another vegetables; so they eat their rice and they get the vegetables there.” Rita has one strategy with the cereal, “I buy cereal without sugar with more oat. I buy sweet to mix, so they like it. I buy a chocolate and mix

it in a big pot, so they don't eat just the sweet one." Inés has one strategy with snacks, "The older girl likes a lot the hot Cheetos [spicy chips in a bag]. We used to watch TV with them and now we get carrots with limes, or chopped mangos, or strawberry, or grapes. I changed all."

Finding 4: All of the parents showed some unhealthy attitudes or beliefs.

Even the parents who showed broad evidence of healthy knowledge and attitudes had some unhealthy attitudes or beliefs. Some parents let children snack without any control. For example, Mirta said, "He escapes and go to the store to get sweet treats. It is 2 or 3 times per week." Some blame the winter weather. For example Alicia said, "The weather (laughs), that is barrier. We have a lot of parks but the weather does not let us."

A couple of parents think that their children will lose weight by themselves in adolescence. Olivia said, "When they grow, it is different. They realize how they are. They get embarrassed and think about change." A couple of parents force their children to eat vegetables. Rita said, "If we go to the buffet, I tell them to eat vegetables otherwise I don't take them back. I always have rules for the food." Last, a couple of parents think that fat is unhealthy for their children. Inés said, "I use 1% milk. The skim one tastes like water, I don't like it. I also changed regular yogurts to light ones." She had gestational diabetes three years ago, received this advice after her diagnosis, and translated this concept to her children's diet. Children are recommended to consume whole milk because they need more fat in their diets than adults do.

The findings described above were the result of the analysis of the observations,

notes, and interviews data of the first session. The following findings were the result of the analysis of the second session. Since three parents used *Lifecast* in the infographic mode, three in comic mode, and three in realistic mode, they are identified in the following findings with the pseudonym and the mode that they used in brackets. Parents had been directed to use the application at least four times between the two sessions. However, not all parents used the app as directed. The researcher helped three parents that had had difficulties using or accessing the application for 30 minutes approximately in the hour before starting the second session. Specifics on those three parents follow.

Abi [realistic] only used the application once after the first session and her data plan expired. The hour before the second session, the researcher explained to her how to use the application on her laptop computer and gave her time to use it. Mirta [infographic] planned to use the app with one of her daughters, but they did not find time to use it. The hour before the second session, I explained to her how to use the application on my computer and gave her time to use it. Hilda [comic] planned to use the application with her son who owned a mobile device; however, he got a new job and she could not use it until the second session. In the second session, the researcher explained to her son-in-law how to use the application on their desktop computer. The researcher concluded that Hilda's experience was too limited and her answers were taken carefully.

Additionally, the researcher found some minor usability issues remaining in the design product, but they are not reported in this stage because it was not a goal of this stage. Additionally, these usability issues were not identified using usability testing

procedures, which may reduce their validity. Rita [comic], who owned a middle range device with Android operating system, reported and showed difficulties with the application crashing frequently. She was upset about that, but she was able to use the application as expected.

The next three findings belong to the theme of changes in health knowledge, attitudes, and behaviors after using the design product. The researcher found some changes in participants after asking a direct question and some after asking open-ended questions.

Finding 5: About half of parents (5 of 9) clearly showed positive changes in knowledge or beliefs about healthy habits.

After using the application, half of the parents showed in the second interview that they gained certain health knowledge. One parent learned the central role of exercise in children's health:

I asked my daughter to put what she eats, and she said, oh it is fat. She doesn't really eat that bad. I don't buy premade food but I don't know why. It is the exercise. So she found that the exercise is what she needs. (Alicia [infographic])

Verónica [realistic] and Abi [realistic] changed their belief that habits do not affect energy feeling. Abi said, "I was wrong. It has to be diet [...] I read it in the app. Diet and exercise, there is no mention of sleep, though they have to sleep at least 8 hours."

Two parents learned that not only the quantity but also the balance and type of food have effects in health. Marco [comic], for example, specifically mentioned that he learned that a diet should be balanced to be healthy and with energy. He said that he used to think that a lot of meat was healthy. He said that he noticed how children in the application gained weight with a lot of meat in the diet. Veronica learned the importance of healthy nutrition, “I believed that eating less I could be thin. But that’s not true. The thing is to try to increase nutritive diet and mainly to maintain active exercise.”

Two parents remarked on the responsibility of the parents about to offer healthy food to their children. Abi [realistic] said, “[I learned] to give a little bit more vegetables to the kids. I don’t give them to my kids. Because they don’t like them, I don’t force them. But I realized that vegetables are good for them.” And Alicia [infographic] said, “I learned the responsibility of the parents. Kids are going to eat what we give them and how we create habits from when they are little.”

Some parents learned other particular concepts. Rita [comic] learned that exercise is not the only solution, “Yes, I thought I could give them to eat quite a bit and take them to exercise, and the true not, it does not work.” Marco [comic] learned the role of plants in energy and to balance diet. He said that fruits and vegetables are essential for energy feeling. He said that he thought that energy came from sweets like chocolate. He also said that the best strategy in the application is to have a balanced diet. One parent, Verónica [realistic], also learned how to influence child snacking, “[I learned] how to reduce snacks, giving them more proteins and more vegetables. This way reduces consumption

of snacks that are not nutritive or healthy for children.” Another parent, Rita [comic], learned that too much healthy food can cause weight gain, “Once [the child] was gaining more weight than I expected. I realized that I put a lot of food. Even though it was healthy, it was too much food.”

Two parents showed understanding of the concept of limiting screen time as a healthy behavior. This concept is presented in the application; however, the responses of the parents do not let concluding if the cause of the attitude is the experience in the application.

Finding 6: Some parents (3 of 9) clearly showed positive change in attitude or behavior about healthy habits.

After using the application, some parents showed in the second interview that they changed in health attitudes or behaviors. Verónica [realistic] has changed the way she controls snacks and she is talking with her children about health: “Lately I have put away stuff so they don’t see them. I have talked to them about how food make you gain weight, like sugars. They have understood, I think.” When Marco [comic] was asked if hiding snacks was a good strategy, he said that he now thinks that it is not. He said that he instead should motivate his kids and talk to them more. And Inés [realistic] was surprised about her child’s diet, “I assumed that the child was my daughter, I put the food that I give her usually, and I was terrified with the consequences.” The researcher observed that she wants to change the diet.

Finding 7: Some parents (3 of 9) used the design product with their children and reported that their children had substantial positive changes in knowledge, attitudes, or behavior.

Even though the researcher did not ask the parents to use the application with their children, three parents took the initiative and used it with their children. Marco [comic] showed the app to his son, who first reacted by having fun. Then, his son became more serious about the content of the app. Marco said he thinks that his son learned from the app too. Another parent said,

It is exciting. My daughter also liked it. She was commenting what was happening in the predictions. She noticed the difference. [...] Yes, she changed. She was surprised. I am always telling her about what not to eat and she does not pay attention, but when she saw the photos and got surprised, she paid attention [...] I told my daughter to try with the food she likes and she said, wow the child in the app got fat. And I said, you see cakes, bad food. Even the healthy children I try to increase the food. Even the ones that had very active exercise get fat.
(Alicia [infographic])

Both of us [used the app]. I told her to look at the app to see the effects. She has 7 pounds extra and I am helping her and talking to her. [Researcher: So, has she changed after using the app?] Yes, she is now getting carrots with lemon, apples, cereal [...] [The app] was the reason. I told her to suppose that she was the one in the app. I told her to pick the food that she would like. She picked and picked, then I told her to see what is the result [...] She believed me, but when she assumed that she was the one [in] the app [the incentive to change was greater].
(Inés [realistic])

This finding was surprising for the researcher because the application was designed for the parents. This indicates that the application may be even more beneficial for children or for parents using the application with their children.

The next finding belongs to the theme of experience using the design product.

Finding 8: The majority of parents (8 of 9) showed motivation and was engaged using the design product.

In the first interview, half of the parents (5 of 9) clearly expressed motivation before using the application by themselves. Through the second interview the majority of the parents (8 of 9) expressed reactions that show that they were motivated and engaged using the application. The majority of the parents commented that the application is a learning tool. Olivia [infographic] said, “It is like a teacher teaching me step by step.” And Verónica [realistic] said, “It is interesting to know tips to help me or my children to control what they eat or try to help them to improve their diets.”

Half of the parents (5 of 9) preferred to select children characters in the application that resemble their children in certain aspects or themselves when they were a child, which explains some of parent motivation. Mirta [infographic] said, “The boy, I was thin when I was young and they tried that I eat and gain weight. The girls, my two oldest daughters, both are overweight. They exercise and lose weight, and fast they are back.” Another parent said,

I have a child that is overweight. So I based myself in what it is good for him, [such as] to not force him to exercise or reduce food. Instead, to motivate him

[...] I felt that I was doing experiments to my own child to reduce weight and be healthy. (Abi [realistic])

Half of the parents (4 of 9) expressed having fun with the application. Mirta [infographic], referring to the time she used the app the hour before the second interview, said, “I liked it a lot, I learned. I did not feel the time being here.” Rita [comic] said, “It is like a game in which you learn and you can teach the kids, too.”

Some parents (3 of 9) experimented with different habits, not necessarily looking to improve the health of the characters. Alicia [infographic] did it to show her children the effects of poor habits. Inés tried to add sweet snacks to see how the character gained weight.

The last finding belongs to the theme of rhetorical appeals in the design product.

Finding 9: Parents do not perceive, at least consciously, differences among the rhetorical modes in terms of appeals to logos (reason), pathos (emotion), or ethos (credibility).

When parents were asked questions about the rhetorical appeals (see Appendix F for interview guide), they had to think to decide upon their answers, especially those related to pathos appeals. Additionally, they were not able to give detailed explanations about their opinions. In terms of appeals to logos, the majority of parents (8 of 9) understood the application. Only Hilda [comic] could not answer this question because she relied too much on family members to use the application on her behalf. Olivia [infographic] indicated that she had difficulties understanding the content about macronutrients on the information page.

In terms of appeals to pathos, the majority of parents (8 of 9), except Hilda [comic], expressed emotional reactions during the experience, such as feeling sorry for the unhealthy characters, confidence and kindness when helping the characters, and happiness when the characters' health improved. Mirta [infographic] said, "I saw her fat and in need of help to lose weight. And the kid, too, he needed help to eat better and gain weight [...] I felt good helping them." Rita [comic] said, "Hard for them, overweight is not ok, kids feel frustrated. In the drawing, one can see the hands down; and when they get better, they have the hands up." And Abi [realistic] said, "I felt good. I felt that I was doing experiments to my own child to reduce weight and be healthy [...] I felt bad because there are many overweight children and they are criticized."

In terms of appeals to ethos, all the parents agreed that the application was credible. Some associated the content with what the health providers have told them. Olivia [infographic] said, "There was food the doctor has explained me." Rita [comic] agreed, "It looks good. They are real-life cases." And Abi [realistic] said, "Yes, it says what is good for children: being active, less screen time. Doctors also say that."

In the last part of the second session the researcher showed all three rhetorical modes to all the parents. And they were surveyed about preference and appeals. The questions included the following: What style (rhetorical mode) do you prefer? What do you think is more effective? What is clearer? What would give you more confidence? What is more credible? Table 5 shows the summary of results.

Table 5.

Survey about Preferences

	No difference	Infographic	Comic	Realistic
Preference				9 _a
Efficacy	3			6
Clarity (logos)		1	3	5
Confidence (pathos)	2		2	5 _b
Credibility (ethos)			1 _c	9 _c

^aInitially, one parent had answered infographic and one comic. Then, they changed their opinions.

^bOne parent said that when using the application with her children the answer would be comic.

^cOne parent said that both comic and realistic have the same credibility.

Parents had an overwhelming preference for the realistic mode. These results show that parents believe that it is the most appealing mode to logos, pathos, and ethos. Mirta [infographic], for example, answered, “The realistic. It looks more real like looking at the person there [...] I like the stories but I said realistic.” Similarly, Rita [comic] said, “The realistic one, because it looks like a real person.” And Abi [realistic] said, “The realistic one because it has the doctor.”

Supplemental quantitative data

In the first and second sessions, the researcher collected supplemental quantitative data to complement the qualitative data and pilot instruments for future quantitative research. Table 6 is a summary of the results of the data listing an independent variable

(rhetorical mode) and two dependent variables (health knowledge and health attitudes).

The data for the independent variables was collected before and after the intervention (i.e., the experience with the application). The researcher did not analyze the data collected in the rhetorical appeals questionnaire because the instrument could not be validated with experts or comparison against valid instruments. Additionally, the parents

Table 6.

Summary of Supplemental Quantitative Data about Efficacy of the Intervention

Parent	Rhetorical mode	Health knowledge pre-test %	Health knowledge post-test %	Health attitudes pre-test %	Health attitudes post-test %
Olivia	Infographic	78	70	84	94
Alicia	Infographic	93	89	88	100
Mirta	Infographic	67	78	91	97
Hilda	Comic	70	59 _a	53	63 _a
Marco	Comic	81	78	88	88
Rita	Comic	81	81	84	88
Veronica	Realistic	67	93	56	75
Abi	Realistic	81	89	72	78
Inés	Realistic	85	89	97	97

^aThis score corresponds to Hilda, who did not use the application as directed. Thus, her scores were not included in the statistical tests.

asked many questions when it was administered, which showed that the instrument needs further development.

The quantitative statistical analyses were not significant, except for the changes in attitudes after the intervention (experience using the application in any of the three modes). This was not a surprise due to the small sample size in the study.

The first statistical test was a paired t test to evaluate if the intervention caused changes in knowledge and attitudes. Whereas changes in attitudes were significant, changes in knowledge were not. Attitudes average after the intervention ($M = 89.5\%$, $SD = 9.1\%$) was higher than before the intervention ($M = 82.4\%$, $SD = 12.7\%$). The mean difference was significant, $t(8) = -3.099$, $p = .017$. Additionally, the effect size of this difference (variance that can be determined by the intervention effect) was large, $r^2 = .58$. Knowledge average after the intervention ($M = 83.3\%$, $SD = 7.7\%$) was higher than before the intervention ($M = 79.2\%$, $SD = 8.8\%$). But the mean difference was not significant, $t(8) = -1.097$, $p = .309$.

The second statistical test was a one-way ANOVA to evaluate if there are differences among the three rhetorical modes regarding changes in knowledge and attitudes. There were not significant differences either in knowledge, $F(2, 5) = 1.685$, $p = .276$, or attitudes, $F(2, 5) = .984$, $p = .436$. This was not a surprise due to the small sample size in each rhetorical mode group.

The last statistical test was a set of Pearson correlations between functional health literacy and the changes in knowledge and attitudes. There was not significant correlation either between functional health literacy and changes in knowledge, $r = .056$, $n = 8$, $p = .895$, two tails, or between functional health literacy and changes in attitudes, $r = .152$, $n = 8$, $p = .719$.

5. Discussion and conclusions

The purpose of this research is to understand the rhetorical appeals (logos, pathos, ethos) in graphic design products created to positively change knowledge, attitudes, and behaviors of people. The researcher aimed to map and define this area of design research within three stages.

In the following sections, the researcher discusses the findings of each stage. In the last section of this chapter, the researcher presents the conclusions of the study and recommendations for future design research and practice.

5.1. Stage 1. Analysis of design products

In the first stage, the researcher analyzed the rhetorical appeals in existing successful graphic design products. The selected products were four animated viral videos about social change. This stage answers research question 1 (How are rhetorical appeals configured in a successful category of design products for social change [i.e., animated viral videos]?) and research question 5 (What are some design principles related to rhetorical appeals in design for social change?). Research methods included a rhetorical appeals analysis and expert interviews.

Level of success of the design products

Initially, the success of the analyzed videos was assessed in their number of views in social media sites. *Story of Stuff* had been viewed more than 7 million times (including 3 million of Spanish and Portuguese translations) in 4 years; *PROTECT IP* had been viewed 5.5 million times in less than a year; *Crisis of Capitalism* had been viewed 1.8 million times in 2 years; and *Ethical Oil* had only 12,000 views in 7 months. Although these numbers show a remarkable exposure of each video, evidence about how they generate social change is debatable.

The efficacy of the videos for social change is a complex issue. Interviewees seemed to agree that people that share beliefs are likely to be the audience of the videos. In other words, a video becomes viral among social networks that have a similar system of values or share a similar frame of reference. Therefore, ethical content is not likely to conflict within the network of similar people. This similarity of values among viewers also indicates that the social change generated for the videos is relative. A large percentage of the number of views is people that embrace the ideas and share values in the content of the video. Therefore, the viewers are likely to have already the desired knowledge, attitudes, and behavior. Nevertheless, these videos are a tool for activism that people can use to press elected officials and generate social change at a level of governmental policy.

Further, the videos are part of larger strategies, which makes it difficult to understand their influence in people's actions. For example, even though persuasive

arguments of videos such as *Story of Stuff* target individual behavior, the partnership of the Story of Stuff Project with advocacy organizations that usually promote public collective action with multiple strategies may explain effects in social change.

Moreover, videos also have objectives other than those focused on social change. Explaining the objective of *Crisis of Capitalism*, Mathew Taylor justified humor as a strategy to increase the reception of new ideas, which is a different objective from social change. He sees emotion as a tool for engagement, and comprehension as a secondary function.

For all these reasons, even though these videos have been successfully received and used by large number of individuals, their actual influence and effectiveness for social change remains unknown or else difficult to measure or to confirm the validity of any data.

Configuration of rhetorical appeals in the design products

In the process of identifying the configuration of rhetorical appeals, the researcher identified salient indices of the rhetorical appeals. Salient indices of appeals to logos include visual simplicity, rational metaphors, audio-visual consistency, appropriate symbols, rational narrative, use of evidence, and clear directions for action. Salient indices of appeals to pathos include emotional elements, emotional metaphors, ethical content, reception comfort, and audience sensitive content. And salient indices of appeals to ethos include neutrality, peer-level visual style, narrator appearance, narrator profile,

narrator tone, and supporting organization.

Regarding to the presence of the salient indices in the videos, *Story of Stuff* takes maximum advantage of the three rhetorical appeals. This video succeeds in creating a sense of urgency while using an informal and calm style. *PROTECT IP* has a lower presence of ethos indices because the video does not make its character clear; nonetheless, the moderate story and tone and the high literacy level of the audience counter this lack. And *Crisis of Capitalism* has a central focus on pathos with humor but is balanced by the rational structure of an academic lecture and the credibility of the RSA.

Interviews with the experts indicated that simplicity is an important tool, but two of the interviewees emphasized the role of appeals to pathos and ethos. Taylor highlighted that the goal of *Crisis of Capitalism* is not simplicity but engagement with humor. O’Heaney argued that the main characteristic of *Story of Stuff* is authenticity, an appeals to ethos that causes empathetic reactions. Conversely, Maibach seemed to give more importance to rational appeals to clarify misconceptions, but he indicated that emotional reactions must be activated before rational information is processed.

One interviewee, Maibach, provided two relevant insights about the use of the rhetorical appeals. First, he recommended not using ethical content because it may conflict with people’s values. He referred to this strategy within climate-change communication, which is a controversial issue. However, a conflict of values may be a practical appeal to pathos if the goal is to evoke anger in the audience. Maibach also

argued that emotions in the audience need to be right in order to have an effective assimilation of the logical argument. He seemed to suggest that pathos should precede logos. This choice, again, depends on the rhetorical situation.

The researcher pointed out in the literature review that the appeals have been interpreted in different forms and perspectives. In part, this variation in interpretation is because Aristotle's chapters on pathos and ethos "seem to have been inserted in the *Rhetoric* without adequate revision" and without examples (Aristotle & Kennedy, 1991, p. 149). Aristotle explained the appeals more than 2,000 years ago, but several interpretations or revisions are available for classic rhetoric (e.g., Braet, 1992) or applied to design (e.g., Buchanan, 1985; Ehses, 2008). However, there is not an available solid framework to make decisions, yet. For comparison of core elements of the rhetorical appeals as found in four sources – Aristotle, Buchanan, Ehses, and the salient indices identified in the videos – see Table 7.

The comparison between these salient indices and the elements described in the literature enables seeing that, though the core elements differ, they do not necessarily conflict. In logos for instance, Aristotle explained that logical reasons in logos are provided using enthymematic syllogisms or paradigmatic inductions (Aristotle & Kennedy, 1991); Buchanan (1985) defined it in design as the technological reasoning for practical circumstances of use; Ehses (2008) proposed guidelines for graphic design such as organization of information, fonts choice, hierarchy, and consistency. Thus, the logos elements in the literature do not perfectly match with the salient indices of appeals to

Table 7.

Core Elements of the Rhetorical Appeals

Reference	Logos	Pathos	Ethos
Aristotle's definitions	-Proving the truth or seeming to prove the (apparent) truth	-Leading the audience to feel emotions	-Credibility in the delivery of the speech (not the reputation of the speaker)
Aristotle's ideas	Logos argumentative options: -Enthymemes (reason-conclusion) -Paradigms (particular observation)	Emotions: -Anger / calmness -Friendliness / hostility -Fear / confidence -Shame / shamelessness -Kindliness / unkindliness -Pity / indignation -Envy / emulation	Ethos reasons: -Wisdom (practical sense) -Virtue (ability to say thoughts) -Good will (prudence and fair-mindedness)
Buchanan's adaptations in design	Technological reasoning for the practical circumstances of use	Emotion and desire	Credibility of manufacturer
Ehres' operationalization in graphic design	-Organization of information -Fonts choice -Hierarchy -Consistency	-Special arrangements -Visual symbolism -Image choice -Color choice	-Applicable to all (credibility, empathy, and reliability)
Salient indices in the animated viral videos	-Visual simplicity -Rational metaphor -Audio-visual consistency -Appropriate symbols -Rational narrative -Use of evidence -Clear directions for action	-Emotional elements -Emotional metaphors -Ethical content -Reception comfort -Audience sensitive content	-Neutrality -Peer-level visual style -Narrator appearance -Narrator profile -Narrator tone -Supporting organization

logos of the animated viral videos described above; nonetheless, they are all related to Aristotle's understanding of logos as the truth or apparent truth of the argument. Pathos and ethos appeals are in the same condition.

There are some exceptions in which ancient rhetorical ideas are transformed significantly in design. For example, for Aristotle the appeal to ethos is the credibility delivered in the speech rather than the attributes associated with the speaker (Braet, 1992), but in design credibility is based on reputation of the manufacturer or the brand. In this case an inartistic element in ancient rhetoric become artistic in design.

5.2. Stage 2. Design project and designer behavior

In the second stage, the researcher, acting as a designer, created a product for social change and observed his own decisions regarding rhetorical appeals for the project. The project included making a mobile web application (i.e., *Lifecast*) for Latino parents about preventing childhood obesity. The application has three modes of use, each mode emphasizing one types of rhetorical appeal. This stage contributed to answer research question 2 (How does the researcher-designer make decisions about rhetorical appeals in the design process?) and research question 5 (What are some design principles related to rhetorical appeals in design for social change?). The researcher-designer made observations on his behavior in designing the product, especially looking at how design decisions are made regarding to the configuration of rhetorical appeals.

Rhetorical appeals decisions in the design process

Since there is not previous research about the designer's behavior in making decisions about the rhetorical appeals, the interpretation of findings in this stage is based solely on the researcher's analysis.

The first finding is that the understanding of the rhetorical appeals changed over the design process. Initially the designer-researcher adopted Ehses' (2008) idea of creating logos-, pathos-, and ethos-driven design products, planning to create a design product with three rhetorical modes (infographic, comic, and realistic), each with a dominance of one of the appeals. This approach allowed starting the execution of the project with a clear strategy for the rhetorical appeals. The designer-researcher was confident in using a reference from the design field.

But findings during the design process indicated that the strategy was not working when the researcher-designer realized that appeals to logos were similar in the rhetorical modes. In other words, the rational reasons provided in the application that aimed to persuade the audience were alike in the three rhetorical modes. This similarity meant that researcher-designer did not realize that Ehses' ideas needed further development for their adaptation. Later in the process, the designer-researcher adjusted, following Braet's (1992) revision of the appeals in classic rhetoric for public speaking. Then, the researcher-designer planned to have a base of appeals to logos that all modes would share and a substantial difference in the configuration of appeals to pathos and ethos.

Even after the plan about the rhetorical appeals seemed clear, the outcome was different than expected. When the product was finished, the researcher-designer heuristically evaluated the outcomes and concluded that there was not a substantial differentiation among the rhetorical modes. This experience shows the design challenge of planning the configuration of rhetorical appeals. Current human-centered methods, such as early prototyping, help little because they do not allow testing the rhetorical abilities of the design products. Early prototypes neither contain refined visual and textual elements nor render the complete experience.

The second finding is related to the design decisions about rhetorical appeals. Decisions focused first on illustration, later on textual and visual elements, and did not include the design concept and the interactivity. The researcher-designer had a clear idea of the style of the graphics for the three rhetorical modes: infographic (information visualization style to show simplicity), comic (cartoon style to create confidence and sympathy), and realistic (photo-realistic style to create respect and credibility). Illustration was the first activity and later visual and textual elements were defined for each mode (e.g., children stories for the comic mode – pathos index, or the University of Minnesota logo for the realistic mode – ethos index).

The goal of the second stage of the design project was to create rhetorical modes with substantial differences. Before the third stage, however, the designer-researcher realized that this goal was not being met. The initial effort had been to focus on creating different rhetorical appeals by varying the visual and textual elements of the design

product, while preserving the homogeneity of other factors (i.e., concept, interactive structure, and format), so as to allow for valid comparative evaluation in the research. However, there is a tension between creating difference in the appeals and controlling for homogeneity of other factors. After creating the design product with the rhetorical modes, it was evident that not only the visual and textual elements, but also other factors (concept, interactivity, and format) could substantially influence how the products appeal to the audience.

For example, if the *Lifecast* application included an option for the parent to create new characters, the parent could enter his or her own child's data and increase the attachment of emotions like shame or confidence. This is a conceptual and interactive change that would work as a pathos index. Another example of how other factors could influence appeal would be to give a score; the application might be seen as a game and reduce the credibility (ethos) because of the association with fiction, but it would increase emotions such as friendliness and confidence (pathos).

Seeing how much other factors could influence the appeal of the application shows that the designer overvalued the relevance of visually perceptible elements. This behavior is likely to be common on the majority of graphic designers, but one designer's behavior is not enough evidence to claim that. The design concept, interactivity, and format, which were the same for all rhetorical modes of the application, could have been also manipulated to explore larger differences among configuration of rhetorical appeals.

Another finding is that before the project execution, the designer needs to define the project plan in terms of conceptual design, interactivity, and rhetorical appeals strategies. The researcher-designer was overwhelmed with project management activities. At the beginning, the illustrators and engineer needed clear directions. Later, other issues such as IRB protocol, health content, and technical decisions about development were time consuming. In *Lifecast*, the density of illustration production and software development required the designer-researcher to execute the plan with limited flexibility. Adjustments that were flexible were limited to stylistic changes in visual and textual elements that do not involve changes in the illustration bank or the interactivity. This finding shows that project management and art direction in contemporary graphic design projects demand designers that are highly organized because the complexity of production reduces creative flexibility.

5.3. Stage 3. Evaluation of a design product

In the third stage, the researcher evaluated the efficacy of a design product for the purpose of motivating use and changing health knowledge, attitudes, and behavior. He also examined how the rhetorical appeals are configured — specifically, he examined the rhetorical appeals of the mobile web application that aimed to change Latino parents in regards to obesity prevention in their children. This stage answers research question 3 (What is the efficacy of a design product [i.e., mobile web application] to motivate use and positively change knowledge, attitudes, and behaviors?), research question 4 (How

are the rhetorical appeals configured in a design product for social change [i.e., mobile web application]?), and research question 5 (What are some design principles related to rhetorical appeals in design for social change?). This stage included design-experts evaluation and real-context evaluation using research methods of heuristic evaluation, participant observation, and in-depth interviews.

Skills of the design product's audience

The understanding of the audience skills (e.g., functional health literacy, health knowledge, and health attitudes) functioned as a baseline to assess social change in the third stage. The findings showed that the parents, even though they were recruited in a health center that serves low-income population, had a medium-to-high level of skills. Their skills can be explained by the recruitment procedure. Parents in the sample have been in the United States for many years (15 on average). Also, since physicians have referred parents' children to the childhood obesity program of the health center, parents are likely to have adequate understanding of and adequate experiences in the health care system. Even with their low schooling, English limitations, and type of health center, the parents had high skills in literacy, knowledge, and attitudes.

The first finding related to audience skills is that all parents are able to use the health care system because they have access to translations services (in Spanish). All parents have lived in the United States for many years and are able to navigate the health care system. The majority regularly uses interpreters, and some rely on family members

for help. Although access to translation services is not a complete indicator of functional health literacy, the scores of the S-TOFHLA (short version of the Test of Functional Health Literacy, Baker et al., 1999) show a similar result. That test revealed that six parents had an adequate level of functional health literacy and three had an inadequate level.

Responses to the interview questions about healthy habits asked of nine parents show two findings in how the parents had high levels of healthy knowledge and positive attitudes. First, the majority of parents (8 of 9) had basic knowledge about healthy habits such as the healthy benefits of exercise and consumption of fruits and vegetables; although a few of them (3 of 9) showed confusion with some concepts because they do not fully understand what is unhealthy and what is the link between habits and energy feeling. One parent showed confusion with many health-related habits concepts. Second, the majority of parents (7 of 9) reported strategies that create healthy habits in their children, such as taking their children to exercise, exercising with them, or adding vegetables to the soup or the rice.

These findings about health knowledge and attitudes are, again, explained in part by the characteristics of the sample. Parents who are referred by physicians to a health program because their children have been diagnosed with being overweight have had more interactions with health care providers than parents who have not been referred.

Another finding from the interview showed that all of the parents had unhealthy attitudes or beliefs; even the parents that showed broad evidence of healthy knowledge

and attitudes had some unhealthy attitudes or beliefs. Examples of these attitudes or beliefs are letting children snack without any control, thinking that their children will lose weight by themselves in adolescence, forcing them to eat vegetables, or blaming the winter for the lack of exercise. These issues are relatively minor and expected; indeed, they probably have other unhealthy and healthy knowledge, attitudes, and behaviors that were not captured in the first interview.

Social change efficacy of the design product

Even though the parents initially had a medium-to-high level of knowledge and positive attitudes about childhood obesity, parents were motivated to use the design product (i.e., the mobile web application *Lifecast*) and exhibited change in their knowledge, beliefs, attitudes, and behavior.

A finding from the second interview revealed that the majority of parents showed motivation and was engaged using the design product. All of them saw the application as a learning tool; half of them selected children in the application similar to their own children; half of them reported having fun; and some experimented with unhealthy habits. Even though the types of motivation varied among parents, it appears common that parents are looking for alternatives to deal with obesity affecting their children. This finding also indicates that one of the goals of the design concept was achieved. The application was designed as an informal learning tool for parents focusing in playfulness

and engagement. This level of motivation was a crucial aspect to facilitate social change objectives.

There are multiple levels, opportunities, and strategies to generate social change (see Heath & Heath, 2010; Maibach et al., 2008). For instance, while some people need more information to increase their knowledge, others need emotional incentives, or others need help to strengthen habits. The findings showed that the application was used in different ways and from different perspectives, which generated unexpected, but positive changes.

A finding showed that about half of parents clearly changed knowledge or beliefs about healthy habits after using the application. These changes included the following: understanding the central role of exercise in children's health; understanding the relationship between habits and energy feeling; learning that food balance affects health; understanding the role of the parents to offer healthy food; and concluding that active exercise without a healthy diet is an insufficient strategy. Another finding showed some parents clearly changed attitudes or behaviors about healthy habits after using the application, such as talking with their children, motivating their children to consume healthy snacks, or considering diet changes for their children.

In the design process, before the evaluation in the third stage, the learning concepts were defined. Examples of these concepts (presented in section 3.4) are physical exercise has a positive effect, or foods with proteins have a positive effect. The revision of these concepts compared to the findings shows that the concepts were too general to

describe the actual potential change that can be generated in people that use the application.

An even more surprising behavior change was generated in the children of the parents. Three parents used the application with their children and reported that their children had substantial changes in knowledge, attitudes, or behavior. Even though parents were not asked to use the application with their children, three of them did use it together. These three parents reported that their children learned from the application and changed. For example, one parent said that her child was not paying attention to food advice, but after using the application together, her child changed and is listening and acting differently. Another parent reported that her child, after using the application, is listening to her, believes her, consumes more healthy snacks, and eats more vegetables. This finding indicates that the application is a flexible tool across ages and a powerful persuasive tool for parents to help their children cope with obesity issues.

The supplemental quantitative data served more as a pilot for future research than as evidence of social change potential in the design product. And yet, there was a significant result: the intervention (i.e., experience using the application in any of the three modes) significantly increased healthy attitudes, with a large effect size that can be attributed to the intervention. However, the other quantitative statistical analyses were not significant (i.e., change in knowledge after the intervention, correlations between functional health literacy and changes, and differences among the three rhetorical modes). Further, the limitations of the quantitative data undermine these findings: the

sample size is too small and the instruments are yet to be proved as reliable and valid measurement of knowledge and attitudes. This supplemental quantitative data collection and analysis provide insights to refine further research in design for social change.

Assessment of rhetorical appeals of the design product

The researcher acted as a designer in the second stage and, before the evaluation of the third stage, assessed the configuration of rhetorical appeals in the three rhetorical modes of the application. Figure 20 (in section 4.2) shows the assessment late in the design process and at the end. Late in the design process, the designer-researcher was expecting that all modes would have a base of logos, the comic mode would have an increased number of pathos appeals, and the realistic mode would have an increased number of ethos appeals. But at the end, he concluded that there were fewer differences than expected among the three modes.

When the application was finished, the assessment of the rhetorical appeals from the design experts and the parents in the sample (audience) was notably different from the assessment of the designer-researcher. Figure 26 is a simple visualization that illustrates the disagreement. For the design experts, the infographic mode had a strong appeal to logos with reduced appeals to pathos and ethos; the comic mode has the highest number of pathos indices; and the realistic mode has the highest number of ethos indices. In the real-context evaluation, the parents' responses did not show differences among the rhetorical modes in terms of appeals to logos (reason), pathos (emotion), or ethos

(credibility). Parents felt challenged by the questions related to the rhetorical appeals and provided limited explanations of their opinions. When they had only used the application in one of the rhetorical modes, they thought that the application had a high level of appeal to logos, pathos, and ethos.

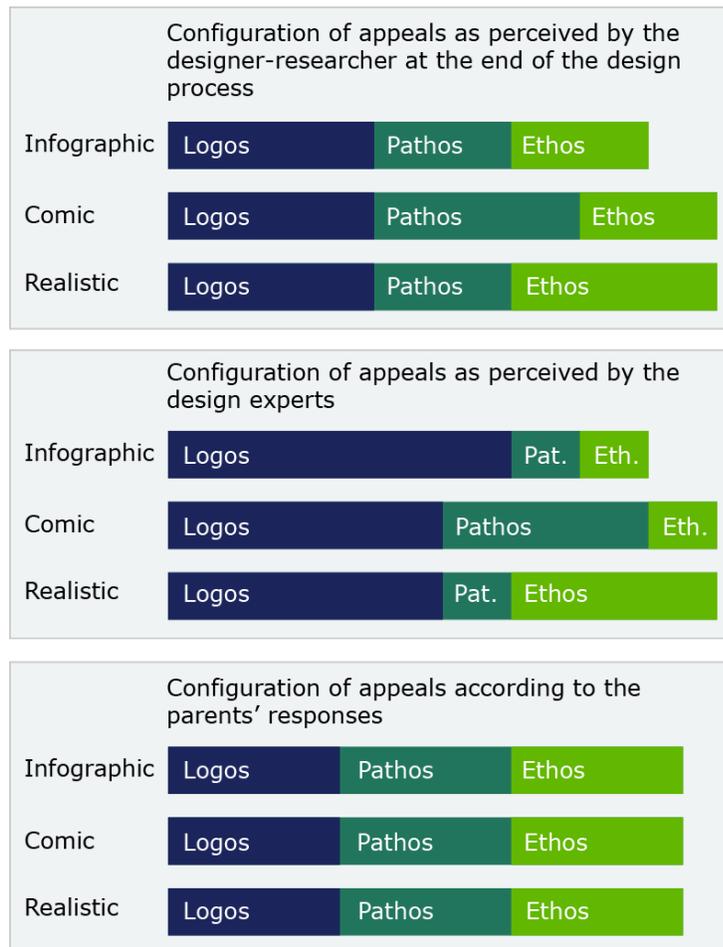


Figure 26. Differences in perception of and response to the rhetorical appeals among the designer-researcher, the design experts, and the parents.

Why are the designer-researcher's own assessment, the design experts assessment, and the responses of the parents regarding to the rhetorical appeals dissimilar if all of them experienced the identical design product? The researcher concludes that the design experts focused on the visual and textual elements of the application, not on the concept, interactivity, and format, because only visual and textual elements differed among the rhetorical modes. Parents, on the other hand, seem to be little conscious about their reaction to the appeals. Further, they did not know the rhetorical situation as compared to the design experts who were instructed about the audience and the objective of the application. Thus, individuals self-reporting on the effectiveness of a design product appeal is not a valid technique yet. Such measurement will need more sophisticated procedures.

Another alternative explanation is that certain indices have effects in more than one appeal. For example, the stories in the comic mode were intended to function as a pathos index; however, stories might appeal to ethos if a parent sees that the stories match real-life, people that they might know or themselves. This matching gives credibility because the application would be empathic and sensible to the experiences of the parent.

Regarding preference, parents, after looking at the three rhetorical modes, had an overwhelming preference for the realistic mode. Parents' responses show that the realistic mode is the most appealing mode to logos, pathos, and ethos. However, preference is not known to be a predictor of changes on knowledge, attitudes, or behavior. Parents argued that the reason for preference of the realistic mode is the direct relation with real life and

the presence of the doctor. This preference might mean that appeals to credibility (ethos) are suitable for this audience, but more evidence is needed.

In section 5.1, the researcher discussed core elements (definitions, ideas, adaptations, salient indices) from Aristotle, Buchanan (1985), Ehses (2008), and the salient indices identified in the analysis of the videos in the first stage (see Table 7). Table 8 shows the rhetorical strategies used for the application. Even though each rhetorical mode incorporates all the appeals, they can be compared with the core elements of Table 7 because each mode has a configuration that focuses on one of the appeals: infographic mode focuses on logos and has reduced number of pathos and ethos indices; the comic mode has increased pathos indices; and the realistic mode has increased ethos indices.

Table 8.

Rhetorical Strategies in the Design Product

	Infographic mode	Comic mode	Realistic mode
Rhetorical strategy for visual and textual elements in the application <i>Lifecast</i>	-Simplicity -Statistics -Information visualization -High graphic abstraction -Technical information -Chunking	-Confidence to use -Reduce anxiety -Create sympathy -Intermediate graphic abstraction with exaggeration and representation of mood -Elicit shame in unhealthy conditions -Stories -Narrative information	-Credibility of information -Accurate content -Branding support (UMN identity) -Low graphic abstraction with representation of mood -Medical information -Medical report and doctor image

The comparison between the core elements of the rhetorical appeals found in the literature and the elements used in this study indicates that the rhetorical appeals are unpredictable theoretical concepts. Aristotle's incomplete treatise of pathos and ethos left the door open to multiple interpretations of the rhetorical appeals, which also has produced flexible adaptation in the field of design.

5.4. Discussion on design research methodology

In this section, the researcher discusses how he made decisions regarding design research methods in four aspects: the limits of design practice, research frames (clinical, applied, basic), research modes (about, through, for), and research paradigms (post-positivism, constructivism, pragmatism). Table 9 is a summary of the methodological characteristics of the three stages in this dissertation.

The lack of agreement and definition about the role of practice in design research is a major challenge in research methods decisions. The researcher decided to limit the discussion on research modes (e.g., research into-about design, research for design, and research through-by design) because there is not a solid reference to have a productive discussion. Regarding to this issue, Friedman's (2008) criticism appears incontestable; he argued that Frayling's (1993) modes are intellectual probes that are not yet validated in design research.

Table 9.

Summary of the Methodological Characteristics of this Dissertation.

Methodological characteristics	Stage 1. Analysis of design products	Stage 2. Design project and designer behavior	Stage 3. Evaluation of a design product
Design practice activities	No	Yes, design of the mobile web application <i>Lifecast</i>	No
Research frame	Applied research	Clinical research as a design method and clinical research in the observation of the designer behavior	Applied research
Research paradigm	Constructivism (within a wider pragmatic paradigm)	Constructivism (within a wider pragmatic paradigm)	Pragmatism (primarily constructivism and supplemental post-positivism)

Methodology in the first stage

This subsection is a reflection about methodological issues in the first stage of the research project. The issues discussed are the limits of design practice, the research frames, and the research paradigms.

Regarding the limits of design practice, this first stage did not have any relation to practice because others designed the products that were analyzed. Indeed, they were

selected because they were viral animated videos. Therefore, this stage had no design practice activities.

The research frame in the first stage is applied research. The goal of this stage was to analyze an aspect of design in four case studies. The videos can be classified within a class of problems in two ways. All of them used similar audiovisual styles in animation and narrative. All of them were targeted toward audiences that do not necessarily have knowledge about the issue discussed in the content. The researcher selected the videos with these characteristics hoping to obtain useful insights and to inform the following stages. It was expected that viral videos had particular configurations of rhetorical appeal that contain guiding principles.

Regarding the paradigm, this stage was conducted using methods of the constructivist approach because the researcher focused on the subjective interpretation of the phenomena and how people develop meanings from their experiences. Both the expert interviews and the rhetorical appeals analysis had the intent of interpreting how the rhetorical appeals persuaded the audience. In this study, the researcher was not solely interested in meanings that people have, but to see how the characteristics of design products influence those meanings.

Methodology in the second stage

In the second stage of the dissertation denominated ‘design project and designer behavior’, the design practice had a major role. Even though research goals were primary

in the dissertation, the design project in this stage was addressed using design methods rather than research methods. There is no doubt that the analytical thinking required in research had a strong influence in the design process; however, that activity's goal was practical and the researcher was immersed in designing. Thus, abductive thinking was primary and analytical thinking secondary. The design product does not constitute a research outcome because by itself it does not have explicit design knowledge for future research. Despite that user research sessions were done with analytical thinking, the findings from these sessions informed the design decisions but they did not constitute the design research activity. Nonetheless, this stage included the auto-observation of the researcher-designer behavior by engaging in reflection and keeping a diary with notes about the process. The findings have valuable insights that may be usable by other designers.

Regarding the frame of research, this stage is clinical research. The clinical research frame refers to research activities that address single problems or situations. The two parallel processes were clinical research. (a) For the design practice, the researcher-designer collected data to support decisions and solve a practical problem. (b) For the auto-observation, the researcher-designer also collected data, this time systematically and not to solve a practical problem, but to understand a particular issue. Of the two processes, only this one, the auto-observation, is considered clinical research that also qualifies as design research.

It is relevant to note that the observation as a research activity is still weak in terms of validity. First, the behavior of one designer may not be enough to provide useful knowledge for other designers and researchers. Additionally, auto-observation is a research method that is largely contested. Findings are reported in the next chapter, but the researcher acknowledges that the methodological limitations are substantial.

Regarding the paradigm, the observation was conducted from methods of the constructivist approach. The goal was to interpret the designer behavior that qualifies as one of the categories of design research proposed by Cross (2006).

Methodology in third stage

In this third stage of the dissertation, the design product was used as a intervention to test efficacy and to study the configuration of rhetorical appeals (rhetorical modes). As explained above, design experts heuristically evaluated the application *Lifecast*, and the researcher tested the application observing and interviewing participants from the audience interacting with it. The findings may serve to improve the design product, which would be a (re) design practice process; however, the main goal was to identify efficacy of the product and to understand the rhetorical appeals rather than to improve the design product.

Within the research frames, this stage is applied research. Similarly to the first stage, the goal was to analyze an aspect of design, but this time in only one product. The product was designed with three rhetorical modes for its role as research instrument or

intervention. The broad class of problems addressed was design for social change, and the narrow class of problems is graphic design for health change in Latinos. The researcher aimed to find principles related to rhetorical appeals that can be used by design practitioners when creating design products for similar audiences or needs.

Regarding the paradigm, this stage was conducted from a pragmatic approach. Even though the core activities belong primarily to constructivist methods, the researcher was interested in design knowledge that provides principles to design in particular types of problems. The methods are constructivist because the researcher explored an area that has scarce previous evidence. Indeed, future experimental studies from a post-positivist approach are needed. Additionally and similarly to the first stage, the researcher is not solely interested in meanings that people have but to see how the characteristics of a design product influence those meanings.

5.5. Conclusions

In this section, the researcher presents conclusions of the study. They are organized as the answers to the research questions. References to the discussion in sections 5.1, 5.2, and 5.3 are used to support the conclusions. Also, recommendations for future design practice and research are given.

Research question 1: How are rhetorical appeals configured in a successful category of design products for social change (i.e., animated viral videos)?

The strength of the three rhetorical appeals (i.e., logos, pathos, ethos) generates a wide reception of graphic design products. The experts highlighted diverse strategies in the viral videos that refer to the three appeals. The most viewed video, *Story of Stuff*, uses the three rhetorical appeals selectively and effectively. However, specific rhetorical situations might require or allow a more flexible or unbalanced approach. For example, *PROTECT IP* has a limited use of appeals to ethos, but it is effective because the audience was already aware of the issues presented.

The identified salient indices constitute a basic model to organize the rhetorical appeal concepts in graphic design. Yet, further development is needed because there are no clear theoretical foundations for a solid interpretation of the appeals either in the literature, or in the analysis of the experts, or in the analysis of the researcher (see Tables 7 and 8).

Additionally, the analysis of the appeals in this format and the insights from the experts gave the researcher awareness to conclude that the digital media alters the principles of rhetoric. In ancient Greece, the speaker delivered the speech situated in fixed time and place with determinate audience. On the Internet, conversely, a design product (speech and speaker) is used in undefined times, is accessible in any place, and the audience is variable according to social media dynamics. Internet and its asynchronic possibilities show that the rhetorical situation is less predictable than in classic rhetoric.

Indeed, the ideal rhetorical audience devised by designers in any project is likely to be different from the rhetorical situation that result when the product is available. Besides, the configuration of rhetorical appeals can be understood dynamically. For instance, an index that appeals to ethos in a subgroup of the audience could appeal to pathos in another subgroup.

Research question 2: How does the researcher-designer make decisions about rhetorical appeals in the design process?

The decisions about rhetorical appeals in the design process demand careful planning and should be continually reviewed during the design process.

First, designers have the option to use conceptual models to guide decisions regarding the rhetorical appeals in design products. Alternatives range from Aristotle's *On Rhetoric* written more than 2,000 years ago, to contemporary interpretations for classic rhetoric (e.g., Braet, 1992) to practical guides in graphic design (e.g., Ehses, 2008). However, since there is not a definitive framework yet, rhetorical analysis of existing design products, either comprehensive or focused on the rhetorical appeals, would help designers to make accurate decisions.

Second, limiting the rhetorical appeal decisions to visual and textual elements and ignoring how design concepts, interactivity, and format affect the appeals result in an intuitive rhetorical strategy. Particularly in digital formats, the way design products appeal to the audience is complex because such a process also includes the interactive structure. Additionally, the design concept goes beyond the semantics of the visual

composition. The design concept also includes the *narrative* and *core mechanics* of the design product.

Third, to successfully start the execution of the project, the designer needs a clear and detailed strategy regarding the rhetorical appeals. This step is particularly critical when the execution demands resources for rigid production such as in software development or motion graphics, as oppose to printed material that may be more easily edited in production.

Research question 3: What is the efficacy of a design product (i.e., mobile web application) to motivate use and positively change knowledge, attitudes, and behaviors?

Based on the parents recruited in this study, Latino parents that have medium-to-high level of health skills are motivated to use the design product (i.e., mobile web application called *Lifecast*). These parents have varied reasons for motivation, such as learning more about healthy food options for their children, appreciating the ability to visualize their children's health in the future, or seeking alternative strategies in to control obesity in their children.

The experience of using the application also changes the knowledge, attitudes, or behaviors of parents. The effects on the parents are not homogeneous, as the researcher acting as a designer planned. Instead, each parent's experience generates specific social change, which is a function of the needs of the individual and the adaptability/flexibility of the application.

Research question 4: How are the rhetorical appeals configured in a design product for social change (i.e., mobile web application)?

The researcher was looking into potential optimal configurations of rhetorical appeals by creating an effective design product for social change (i.e., a mobile web application called *Lifecast*). He exposed the audience to the application that had three different rhetorical modes and expected to understand how the varied configurations of rhetorical appeals generated specific reactions in the audience. Nonetheless, the researcher found that each of the three modes had strength on all three of the rhetorical appeals. He found that, even though the rhetorical appeals are influenced by visual and textual elements, they are mainly determined by the design concept and the interactivity; all the rhetorical modes in the application share this strength of the appeals.

Including the interactivity in the strategy of appeals posits, to designers, further challenges in terms of dynamic rhetorical situations. Above, the researcher contended that the asynchronic possibilities of the Internet unsettle the rhetorical situation because the audience accesses the speech at undefined times and places. The interactivity adds another layer of complexity because every individual in the audience is able to tour the interfaces in different ways creating different speeches.

Another conclusion regarding this research question is that there is not an accurate theoretical model to assess rhetorical appeals in design products. In section 5.3, substantial differences in assessment of the rhetorical appeals among the designer-researcher, the design experts, and the audience was described and discussed (see Figure 26). These differences are explained by the lack of a clear theoretical model for

interpretation and evaluation. As said above (see section 5.1), Aristotle's *On Rhetoric* left questions that have been answered from multiple perspectives.

Research question 5: What are some design principles related to rhetorical appeals in design for social change?

Since this is a study that centered on mapping a research area, there is not enough evidence to define principles; instead, rules of thumb are presented below. Further research is needed to validate or reject them as universal design principles. These rules of thumb are based on the findings of this study.

- To reach a wide audience, use all of the appeals; yet be selective in how to balance the appeals, attending to needs of the rhetorical situation. This recommendation means that presence of the three rhetorical appeals in design products would help the products persuade a large number of individuals in the audience. But the designer should select the appeals to incorporate rhetorical arguments and indices that are most suitable in the particular rhetorical situation.
- Use increased pathos indices to engage the audience. When people feel emotions triggered by the design product, they are more likely to be attentive in the interaction experience.
- Focus on logos arguments when targeting high literacy audiences in design products that provide information. This kind of audience, when it needs specific information, does not need motivation or engagement.

- Enrich logos arguments with pathos and ethos indices to increase motivation and facilitate change. Whether or not the audience has sufficient knowledge, emotion and credibility help them to engage in behavior change.
- Because the lead designer is the one who knows the most about the rhetorical situations (goal, audience, place, time), he or she, as oppose to other design experts or the audience, is the one who can heuristically assess the configuration of rhetorical appeals. Exceptions to this rule might be (a) an external design expert committed to fully study the rhetorical situation and (b) availability of validated instruments to measure the effects of rhetorical appeals in the audience.
- Latino parents prefer appeals to ethos in visual and textual elements. They acknowledge the credibility of health centers and health care providers. They also say that high iconicity (or low abstraction) in graphics works better to represent body health.
- A strategy of rhetorical appeals involves all characteristics and aspects of the design product, including not only visual and textual elements, but also the design concept, the interactivity, and the format.

Research question 6: What are the appropriate methods to do design research?

Ideally, design research methods should not be limited solely to design practice, it should focus on an applied research frame, and it should be based on a pragmatic paradigm. This is the conclusion of the researcher; however, he acknowledges the limited

agreement among design scholars and the lack of experience among design researchers could take the immature design field towards alternative directions.

Design practice alone is not research and even reflection in parallel to practice may not be enough to obtain validity and, hence, qualify as research. This study included a design practice project because the proposal was to create instruments for testing with specific qualities. In the second stage, the design project included a practical goal of designing, but within the wider research project the created design product did not answer a research question. It is more likely that other research questions may not require engaging in design practice but the utilization of existing design products.

With reference to the research frames, the researcher agrees with Buchanan (2001) that the majority of design research is placed in the applied research frame. The frame of clinical research may be confusing because of the use of the word research. It is critical to distinguish between clinical research to inform practice and clinical research to systematically analyze a case study. Only the latter is design research.

Regarding the research paradigms, design researchers need to take a pragmatic approach in which they assess methods according to the research questions. There may be cases that either a known constructivist or post-positivist approach is enough, but in other scenarios, the design research may have to be adapted and pragmatically use diverse data collection methods innovatively. A central concern should be to assure validity of the methods and to be able to find generalizable or transferable evidence.

Recommendations for design practice

Based on the conclusions above, the researcher proposes the following recommendations for design practice. First, design practitioners should use the rules of thumb proposed above for design products for social change. In section 2.1, the researcher argued that in this class of design products, a large amount of information is delivered and the aim is to positively change knowledge, attitudes, or behavior. Simple design products, in rhetorical terms, are intended to primarily adapt to, not change, knowledge, attitudes, and behaviors of people; for instance, spoons, signs for wayfinding, or diagrams of instructions. Another relevant distinction is about the scope of the design problem. Some design projects are limited to the problem of interface. In this case, usability and simplicity are the primary goals. The rules of thumb proposed above do not apply to these projects.

Interface design problems, that concentrate on usability, value simplicity and appeals to logos to facilitate cognitive use. This should not be the strategy to communicate complex issues to audiences such as those dealing with social change. The contemporary influence of cognition in visual design is valuable, but designers cannot rely only on reason and simplicity to persuade people in complex social issues.

When designing for social change, the researcher also recommends creating social-change flexible design products. Individuals in the audience have dissimilar levels of knowledge, attitudes, and behaviors. Thus, design products should be able to positively impact different individuals. In the design product created in this dissertation (i.e., the

mobile web application *Lifecast*), the researcher observed diverse positive effects generating change in different ways. For example, some people preferred to use the application with their children, some preferred to learn from the menu, and some preferred to explore unhealthy habits to understand them. A good design product should be able to adapt to diverse possible scenarios of use. This adaptability should lead to flexible opportunities to generate social change.

Another recommendation is related to the graphic design format. Visual and textual elements determine the design concept and the rhetorical strategy in simple printed format such as posters. However, design products in digital formats, such as online videos or mobile web applications, add other layers. The design concept and the interactivity include elements such as narrative and core mechanics that can be manipulated as part of the rhetorical strategy. Also, in these formats, the designer should be aware of the variability of the rhetorical situations; he or she should conceive products that have more adaptability to the audiences that generate multiple situations in place, time, and goals of the experience.

Regarding project management issues, an effective use of rhetorical methods in designing needs sufficient definition of rhetorical strategies, such as those regarding the rhetorical appeals, before starting the execution or production. Execution brings up time-consuming project management and technical issues. Thus, rhetorical appeal strategies need to be clear in the planning phase. One alternative is that the early evaluation is to test not only for usability but also for the rhetorical ability of early prototypes.

Recommendations for design research

Further research is needed to determine the best configuration or configurations of rhetorical appeals in design products for social change (e.g., positive change of knowledge, attitude, and behaviors). Admittedly, rhetorical situations cannot be standardized because they change depending on exigency (issue or goal), place, time, and the characteristics of the audience. Thus, there will be a level of generalizability or transferability depending on the distinctive social change study cases. In this dissertation research, one decision regarding the rhetorical appeals was that the high iconicity (or low abstraction) of the body image was an ethos index. This index is transferable to many similar cultural groups (e.g., minorities, low income people).

Future research about rhetorical appeals in design should also include not only visual and textual elements, but also other constitutive elements of design formats such as narrative, core mechanics, or interactivity. Then, design products that have different interactive structure will better serve as instruments to compare and evaluate differences of efficacy in the configuration of rhetorical appeals. The challenge will be selecting or creating design products that have enough difference in appeals while being still comparable. For example, two products with opposite social change goals or audiences will not be comparable. A practical alternative in future research is to test only two configurations of rhetorical appeals: one with minimal pathos and ethos indices relying on simplicity and usability (that would reflect current design trends that value cognition) and one with increased pathos and ethos indices (that would reflect a rhetorical and

cultural approach to design).

Regarding design research methods, the researcher has five recommendations. First, reflection in design research methodology is useful for rigor. Future research should assess what activities constitute design practice and design research. Design practice alone is not research. Also, the understanding of the research frames (clinical, applied, basic) and paradigms (constructivism, post-positivism, pragmatism) helps to plan effectively and have consistency among research questions, data collection, and data analysis. The researcher recommends a pragmatic approach in response to the diverse types of questions that are possible in design research. However, further studies in methodology should improve the understanding of the role of pragmatic thinking in the field.

Second, future research should pay special attention to the recruitment procedures to assure that the audience skills match the research objectives and questions. In the third stage of this dissertation and within the real-context evaluation, parents, unexpectedly, had a sufficient level of health knowledge and healthy attitudes. Although the application (i.e., *Lifecast*) generated positive change in this audience, parents with lower level of knowledge and unhealthy attitudes would have provided further understanding of the potential of the application. Alternatively, if the audience has a high level of knowledge and positive attitudes, the design product and the outcome evaluation should focus on assisting and measuring behavior change.

Third, future research should use methods that permit emerging patterns of social

change. Not all change can be observed comparing data of before and after using design products. In the segments above, the researcher noted that individuals in the audience have dissimilar levels of knowledge, attitudes, and behaviors, which means that design products should adapt to diverse possible scenarios of use and generate flexible opportunities for social change. Therefore, the researcher should consider using constructivist or mixed research approaches to allow capturing emerging patterns of social change that would not be captured with post-positivistic instruments of data collections, such as validated fixed questionnaires.

Fourth, research that involves creating design products, as research instruments or interventions, requires incorporating user research activities about efficacy. The researcher could create an intervention first (e.g., experience using a mobile web application) and pilot it to understand the potential social change effects. Clear social change would allow a design researcher to generate design knowledge by, for example, having statistical significance comparing configurations of rhetorical appeals.

Last, future research in a similar case study (i.e., minorities' health) should be conducted including post-positivistic or mixed research paradigms. This dissertation was an effort to map issues related to design for social change from a rhetorical approach. Research activities were exploratory and pragmatic, and they primarily used qualitative methods. Diverse collected data allowed contrasting the findings to gain understanding of the research problem. The results provided in this chapter are sufficient to plan experimental research.

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7. Appendices

7.1. Appendix A: Interview guides for expert interviewing

Interview guide, Matthew Taylor, chief director of RSA

1. How do *RSA Animate* videos contribute to social change? Is there evidence?
2. There is a large impact if we consider number online views, have the videos influenced government policies or corporate decisions? Is there evidence?
3. In my analysis, I think that the humorous drawing distracts viewers from the lecture content, what do you think?
4. Do the videos help people to understand better or are they only a comfortable way to attend a lecture?
5. Are the videos appealing reason, emotion, or credibility?
6. Some videos such as the *Crisis of Capitalism* have a specific political position, how do people with opposed political positions receive the message?
7. What is the impact of these videos in low literacy people and developing worlds?
8. Do you recommend any article or paper related to these issues? What about experts?
9. Are number of online views correlated to social change?
10. Do they improve understanding or only have political influence?

Interview guide, Kirby Ferguson, producer of PROTECT IP video

1. The *PROTECT IP* video in YouTube has been seen by about half million people, how do you think that the number of views is correlated to actual individual actions against PROTECT IP Act? How many sign the petition after looking at the video?
2. Is there any direct or indirect effect on decision makers and lawmakers?
3. What are the visual style and content qualities that make the media popular?
4. What online format has more potential? Video, infographic, or games?
5. What is the role of reason, emotion, and credibility? Which one is more critical?
6. There is a clear political influence on the video; does the video actually improve understanding of the issue?
7. Does the video have the ability to communicate across audiences from liberal left to religious right?
8. Is fear well managed and effective in *PROTECT IP* video?
9. What is the impact of these videos in low literate audiences and audiences in the

developing world?

10. Do you recommend any article or paper related to these issues? Do you know any other potential interviewee?

Interview guide, Michael O’Heaney, co-director at the Story of Stuff Project

1. The *Story of Stuff* video series has been seen by millions of people, do you think that the number of views is correlated with pro-social behavioral change? In other words, is the success in views also a success in the desired opinions, intentions, and behavior about the environment and other tackled social issues?
2. How does the popularity of the media push decision makers to act? Is there evidence?
3. What are the visual style and content qualities that make the media popular?
4. What is the role of reason, emotion, and credibility? Which one is more critical?
5. What online format has more potential? Video, infographic, or games?
6. What is the impact of these videos in low literate audiences and audiences in the developing world?
7. Do they improve understanding or do they only have political influence?
8. Do you recommend me any article or paper related to these issues?
9. Do you know any other potential interviewee?

Interview guide, Edward Maibach, director of the Center for Climate Change Communication at George Mason University

1. Are you familiar with *Story of Stuff*, *Ethical Oil*, and *RSAnimate*? Do you know their popularity?
2. What are the visual style and content qualities that make the media popular?
3. These videos are clearly individual level strategies, have they generated (or can they generate) social network, community and place level strategies?
4. How does the popularity of the media push decision makers to act? Is there evidence?
5. Do the videos have the ability to communicate across audiences from liberal left to religious right?
6. What is the role of reason, emotion, or credibility? Which one is more critical?
7. Do you think that the number of online views is correlated with social behavioral change?
8. What is the impact of these videos in low literate audiences and audiences in developing worlds?
9. Do they improve understanding or do they only have political influence?

7.2. Appendix B: Design expert evaluation form of mobile web application

Expert heuristic evaluation of rhetorical appeals

The goal of this activity is to evaluate how the rhetorical appeals (logos, pathos, and ethos) are being applied in a mobile web application and its three graphic modes (infographic, comic, and realistic)

Research Study

One of the research questions of the study is to identify which visual rhetorical configuration appeals to low-income unprivileged people. For this we created a visual communication system-a mobile web app that includes three modes of use, each with different configuration of appeals. For example, one mode may appeal more to the ethos of the people than the others.

Lifecast

The visual communication system is a mobile web application called Lifecast. The app addresses the relationship of diet and exercises with childhood obesity. Lifecast is targeted to low-income Latino parents and it serves as a tool for parents to learn about children's diet and exercise. The app allows the user to select different children ranged from overweight to healthy conditions; to change their regular daily intake and weekly exercise; and ultimately simulate their weight and health conditions in the future based on the selected diet and exercise variables. Because of the projected body weight feature, the user will be able to see the direct effects of food and exercise in children. With this simulation, we hope that the app will create mind-change effect in how parents influence their children's eating and exercise habits. Our hypothesis is that visual language would be particularly powerful in low-literacy groups.

Audience

Low-income Latino families living in the Minneapolis area, Minnesota (USA) with at least a child age between 6-12 years and access to smartphones will be recruited. In this group of population, mothers are more likely to be the users of the app and have higher responsibility on children's diet. These parents connect to the Internet using the phone and are not likely to have desktop computers. When they connect, they use Internet mainly to search for information of diverse interest and access to Facebook, the most popular social media network in Latinos. They have lived between 10 to 30 years in the United States and some or all of their children were born in the USA. Some of them are likely to be undocumented immigrants.

At home they are likely to prepare Latino food. The large majority is Mexican and has relatively good access to Mexican ingredients due to the number of Mexican grocery stores in their neighborhoods. Latino and Mexican homemade food usually includes tortillas, beans, chicken, cheese, cream, tomatoes, and chilies. Soda has become part of their typical diet. In the States they start more often to eat out food like burgers and pizza.

Latino children have double rates of obesity compared to European American children. In the Latino culture, chubby children are considered and perceived to be healthy. Parents may not recognize the weight problem until children visit the doctor. They acknowledge the authority of the doctor and usually try to follow his or her instructions. They also recognize the two major health care centers in the region- the Hennepin County Medical Center and the University of Minnesota hospitals/clinics.

Latinos like to watch Spanish language channels, which have many soap operas. They have strong family ties and many may have relatives living close by.

App activities

1. Explore the app to get familiar with it.
2. Notice that you can change the 'graphic mode' in the settings page. Notice that graphic mode change graphics as well as verbal content.
3. Experiment with 2 or 3 characters, observing their health and weight prediction, changing their habits, and looking at all the graphic modes. Please make sure to change habits and observe again the prediction. Also, look at the 'more details' page to read complementary information.

Evaluation

For each mode of use assess according to the parameters. Please keep in mind that the target user is not you but the people described above. The objective of this evaluation is to determine the configuration of rhetorical appeals (logos, pathos, and ethos) in each graphic mode. Please mark in the scale if you agree or disagree accordingly.

Please add observations and/or comments below, and then fill the form in page 3:

		Strongly agree	Somewhat agree	Neutral	Somewhat disagree	Strongly disagree
<i>Logos</i>						
Verbal and visual information in this mode is clear to present the content	Infographic					
	Comic					
	Realistic					
Verbal and visual information in this mode is sufficient and complete	Infographic					
	Comic					
	Realistic					
This mode allows logical understanding	Infographic					
	Comic					
	Realistic					
<i>Pathos</i>						
Verbal and visual information in this mode is friendly and empathetic	Infographic					
	Comic					
	Realistic					
Verbal and visual information in this mode help to create confidence in the user	Infographic					
	Comic					
	Realistic					
Verbal and visual information in this mode show that non-healthy conditions are shameful	Infographic					
	Comic					
	Realistic					
This mode makes the user feel that he or she is helping the characters and being kind	Infographic					
	Comic					
	Realistic					
<i>Ethos</i>						
Verbal and visual information in this mode reinforce credibility	Infographic					
	Comic					
	Realistic					
Verbal and visual information in this mode show accuracy of the content and simulation	Infographic					
	Comic					
	Realistic					
This mode shows that the users' culture was considered	Infographic					
	Comic					
	Realistic					

**7.3. Appendix C: Health knowledge test and health attitudes
questionnaire for real-context evaluation**

University of Minnesota
College of Design, Department of Design, Housing, and Apparel
Health and Nutrition
Questionnaire

1. A child will have more energy to study if he or she usually:

- | | | | |
|---------------------------------|------------------------------|-----------------------------|---------------------------------------|
| Does little exercise | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Exercises | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Eats more fruits and vegetables | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Drinks more soda | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Eats three meals a day | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Eats more snacks | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |

2. When a child is overweight, what should his or her parents do if they want him or her to be healthy?

- | | | | |
|---|------------------------------|-----------------------------|---------------------------------------|
| Change food items in the diet | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Help him or her lose weight as fast as possible | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Prohibit snacks between meals | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Limit screen time (TV, computers, phones) | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Encourage the child to exercise | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Force him or her to practice a sport | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |

3. For children to reduce unhealthy snacks (like soda, chips, or cake), parents could:

- | | | | |
|--|------------------------------|-----------------------------|---------------------------------------|
| Include more meats in the meals | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Include more sandwiches in the meals | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Order delivery pizza for the meals | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Include more beans in the meals | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Include more sweet cereal in the meals | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Include more vegetables in the meals | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Just prohibit snacks | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |

4. Which one of these food items help children to feel more energetic?

- | | | | |
|----------------------|------------------------------|-----------------------------|---------------------------------------|
| Chicken | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Beans | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Soda | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Sweet cereal | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Milk | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Pizza | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Bottled Orange Juice | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |
| Eggs | <input type="checkbox"/> yes | <input type="checkbox"/> no | <input type="checkbox"/> I don't know |

Please place a checkmark in the box that best represents your attitude to the statement.

	Strongly agree	Somewhat agree	Neutral	Somewhat disagree	Strongly disagree
Parents should pay attention to the food their children eat.	<input type="checkbox"/>				
Parents should give children any food they like at anytime.	<input type="checkbox"/>				
Parents should influence what their children eat.	<input type="checkbox"/>				
Parents should control the screen time (on TV, computers, phones) of their children.	<input type="checkbox"/>				
Parents do not have to worry about overweight children because they will thin out in adolescence.	<input type="checkbox"/>				
It is OK that children eat fast food like burger OR pizza once every day.	<input type="checkbox"/>				
It is OK that children eat vegetables twice a day.	<input type="checkbox"/>				
It is OK that children eat sweet cereal and milk twice a day.	<input type="checkbox"/>				

Thank you very much!

7.4. Appendix D: Interview guide for real-context evaluation before the intervention

Demographic

1. Where are you from?
2. How many children do you have? How many from 6 to 12 years of age?
3. How long have you lived in the United States?

Functional literacy

4. How many school years did you complete?
5. When people move, they may have to learn how to use local services such as health care services. How has been your experience using health care services in the USA?
 - a. Prompt: Talking to doctors, reading medicines directions, getting insurance?

Knowledge and attitudes – Physical exercise

6. What do you think is a healthy level of exercise for your children?
 - a. Prompt: What is your influence? What would you change?

Knowledge and attitudes – Diet

7. What do you think is a healthy daily diet for your children?
 - a. Prompt: What is your influence? What would you change?
 - b. Prompt: How often should your children to eat fast food?
 - c. Prompt: How often should your children to eat vegetables?

Knowledge and attitudes – Energy, nutrients, weight

8. Do you feel that your children have enough energy to study?
 - a. Prompt: How diet and exercise affect it?
 - b. Prompt: Portions? Food items? Exercise? Nutrients (proteins, vegetables...)?
9. Do you think that your children will be overweight in the future?
 - a. Prompt: What is the major challenge?
 - b. Prompt: What should you do?

**7.5. Appendix E: Rhetorical appeals questionnaire for real-
context evaluation**

University of Minnesota
College of Design, Department of Design, Housing, and Apparel

Lifecast App
Questionnaire

Please place a checkmark in the box that best represents your opinion.

	Strongly agree	Somewhat agree	Neutral	Somewhat disagree	Strongly disagree
The content of the app is clear	<input type="checkbox"/>				
The app has sufficient information	<input type="checkbox"/>				
The app is easy to understand	<input type="checkbox"/>				
The app is friendly	<input type="checkbox"/>				
I felt confident making decisions in the app	<input type="checkbox"/>				
Children with overweight and obesity look ashamed in the app	<input type="checkbox"/>				
I felt that I was helping children in the app	<input type="checkbox"/>				
The app content is credible	<input type="checkbox"/>				
The predictions of the app are accurate	<input type="checkbox"/>				
The app is designed taking in account Latinos customs and foods	<input type="checkbox"/>				

Thank you very much!

7.6. Appendix F: Interview guide for real-context evaluation after the intervention

App – General

1. How was your experience using the app?
 - a. Prompt: How often have you used the system?
 - b. Prompt: Did you enjoy? Do you have any questions?
 - c. Prompt: Where you motivated to use it? Why?

2. What did you get out of it?
 - a. Prompt: What did you learn? What parts of the app helped you to learn these things?
 - b. Prompt: Did it change your ideas (beliefs)? If yes, what parts of the app helped do that?
 - c. Prompt: Did you try to improve health of children? What was your strategy?
 - d. Prompt: Is the app useful for your own children?

3. Will you use the app in the future? How?
 - a. Prompt: Would you tell your friends about it?

Healthy knowledge and attitudes

4. In the first session you said [from analysis of each parent first interview]
 - a. Prompt: Do you have any new opinion after using the app?

5. In the first session you said [from analysis of each parent first interview]
 - a. Prompt: Do you have any new opinion after using the app?

App – Rhetorical appeals

6. How confident did you feel about what you chose to do with the app?
 - a. Prompt: Is the app clear?
 - b. Prompt: Is it complete?
 - c. Prompt: What was the process of understanding?

7. How confident Did you feel about your decisions?
 - a. Prompt: Did you identify with the children in the app? (empathy)
 - b. Prompt: What do you feel about overweight children in the app? (shame)
 - c. Prompt: How did you feel when a child improved?

8. How credible is the app?
 - a. Prompt: Is it accurate?
 - b. Prompt: Do the creators of the app take your culture into account?