

It's Comical: When Facts in Comic Form Persuade

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ABSTRACT

This paper looks at the ability of algorithmically synthesized comic-style messages to persuade individuals to adopt behaviors. In collective action dilemmas including climate change and public health, persuasive messages are an important aspect of enabling individuals to adopt behaviors that benefit themselves and the larger group. Whether comic representations, despite widespread use in popular culture, offer any tangible benefits over plain text messages containing the same information remains unclear: standard results from game theory suggest recasting informative messages through comics cannot make any difference. Drawing on a rich history of the comic book form and theories from behavioral psychology, we synthesize persuasive messages in an abstract comic form. Through an online experiment, we analyze the effects of three key elements in comics: gestures inter-character distance, and background shading on their ability to persuade individuals. Our results suggest people perceive the comic representation as more persuasive than the plain text and that three key comic elements moderate the persuasiveness differently.

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous; See <http://acm.org/about/class/1998/> for the full list of ACM classifiers. This section is required.

Author Keywords

Authors' choice; of terms; separated; by semicolons; include commas, within terms only; required.

INTRODUCTION

Today, the world generates information all around us every second. We are surrounded by all sorts of messages trying to change what we think and what we do: our newsfeed is full of advertisements, our wearable devices are keeping telling us to exercise more, even our water bottle starts to push notification to remind us drinking more water. However, not all messages can successfully change our behavior: we won't buy an expensive car because of a short video, we often eat junk food even though we received a lot of articles about health eating and we are often in the status of dehydration after reading those notifications. Thus, how to make a message more persuasive has been a critical problem throughout the years.

While classical game theory suggests that recasting an informative message through a different form cannot increase the message's persuasive power, a rich body of research has demonstrated how susceptible we are to those fancy words. Hotel guests start to reuse their towels more because of a subtle change of a sign positioned on washroom towel racks. Households start to reduce their energy consumption because of an emoji on their energy bill. People are more willing to sign up for a prosocial peer-to-peer service because of a message on the sign-up page telling them explicitly what benefit they might get. Given the susceptible nature of our species, we believe changing the representation of a message can make the message more persuasive.

Comics, a medium to express ideas in a graphical form, are one of the most popular form of art across different cultures. The history of comics can be traced back to early precursors such as Trajan's Column. Comics are usually in the form of juxtaposed sequences of panels of images or a standalone single image. Beside the graphical representation, textual elements such as speech balloons, captions, and onomatopoeia often communicate dialogue, narration, sound effects, or other information. Existing work shows that reader often prefer comics over plain text since comics are more attractive and more engaging than plain text. Yet the persuasiveness of the comics representation has not been investigated.

In this study, we present a research on the persuasiveness of comic style messages. First, we reviewed some of the previous works on persuasive technologies in three major fields: (1) framing and phrasing of messages, (2) comparison between text and comic, and (3) communicating through comic and graphics. Second, we discuss about the general composition of a comic message and its comparison with plain text. Lastly, to examine our hypothesis that comic messages are more persuasive than text messages, we conduct a field experiment on

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CHI'16, May 07–12, 2016, San Jose, CA, USA

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DOI: http://dx.doi.org/10.475/123_4

Amazon Mechanical Turk to investigate the persuasiveness of comic messages comparing with text messages. The result shows comics can be a better form of persuasive message comparing to plain text and three key comic elements, character gesture, inter-character distance, and background shading moderate the persuasiveness differently.

The contributions of this work are: 1) extending on previous research to not only whether comic messages can attract reader's attention, but also whether comic messages can actually motivate readers to take action. 2) among the first to examine the effect on reader's behavior for comic form messages.

RELATED WORK

Research on persuasive messages in HCI has been increasingly popular due to the fact of information explosion. Previous research has provided solid strategies that can make text messages more persuasive, including messaging framing, information-centric approaches, and personalize information context [?, ?, ?, ?, ?, ?, ?]. However, due to the advance in technology, we are immersed in the information ocean and overwhelmed with texts various sources. How to make individual message stand out among others and attract reader's attention while nudging the reader to make behavioral and attitude changes becomes an important problem. In this study, we looked into a novel form of persuasive message, visual comics. Then, we investigated the persuasive power of different visual cues in comics beyond pure text. In the following sections, we will introduce related studies categorized into groups: (1) Building Persuasive Technology, (2) Computational Persuasion and (3) Persuasion Through Comics.

Building Persuasive Technology

Starting from Goehlert's discussion on persuasion and communications technology in 1980, HCI researchers have spent a lot of effort in leveraging technology in persuasion[?]. Goehlert argues control and dissemination of information have the ability to make attitude and behavioral changes[?]. Inspired by this argument, two types of approaches have been used in constructing persuasive systems. Information-centric approaches focused on delivering hidden or new information which has not been perceived or recognized by the user before[?]. For example, Chi et al. created an intelligent kitchen that can provide nutritional information about ingredients while users are cooking[?]. People start to adjust their ingredients usages to achieve a better nutritional composition. Waterbot persuades people to engage water-saving behavior by augmenting physical sink interface with water usage indicators[?]. Liao and Fu found showing a source expertise indicator can shape user's information seeking behavior and burst the filter bubble [?]. While a lot of studies on persuasive technology evident the persuasive power of this information-centric approach, previous studies also show the downside of information-center approach where the target receiver often failed to perceive and rationalize the persuasive information when the receiver is experiencing information overload [?, ?]. Additionally, the information-centric approach often relays on the target receiver can make rational decisions based on provided information whereas the premise of rationality does not always hold.

Adapting decision-making models from previous behavioral research, some persuasive technology emphasized on human motivation and biases, e.g. behavior-centric approach [?]. Lee et al. incorporated the idea of default bias in the design of the Snackbot robot and successfully persuade people with healthy snacking in the workplace [?]. Vaish et. al used self-serving motivational framing of messages to persuade people to sign up for a prosocial peer-to-peer service[?]. Borrowing from the theory of planned behavior, Schneider et. al understood different motivational factors of mobile fitness coach users and delivered individualized messages to persuade users based on their motivations[?]. Although the effectiveness of

behavior-centric approach has been examined in multiple studies, behavior-centric approaches often require prior knowledge of target subject in order to maximize the persuasion power, as Orji et. al and Schneider et. al suggested in their study that different people may be more valuable to one persuasive method than others[?, ?]. Therefore, the common challenging faced by behavior-centric approach is scalability.

Our study, we leveraged both information-centric and behavior-centric approaches. The comic is designed to show user's behavior stats (information-centric) but the message is framed beyond raw representation to achieve maximum persuasiveness (behavior-centric). The challenge here is mitigating the downsides of information-centric and behavior-centric approaches. We used novel representation, visual comic, to catch information receiver's attention and developed a tool that can algorithmically generate personalized persuasive comics.

Computational Persuasion

With the advance in human technology and artificial intelligence, in very recent years, researcher starts to consider persuasion as an automated process where a computational model can algorithmically persuade target persuadee with effective persuasion strategies, e.g. engaging conversation with virtual agents[?, ?, ?]. Huang and Lin proposed a virtual sales agent to persuade potential customers to offer a better price [?]. By using machine-learning-based approach, an augment graph is trained based on simulated scenarios. Through a laboratory and online experiment, the results show this virtual sales agent can increase buyer's product valuation and willingness-to-pay efficiently. However, the persuasive power may be traded if such virtual agent provides inappropriate augmentation. Nguyen and Masthoff reviewed a number of argumentation-based systems and concludes comparing to the confrontational approach, arguments that based on social relationship and intrinsic motivation may be more efficacious [?]. Kang et. al developed a computational model called Model for Adaptive Persuasion that provides a unified framework for different persuasion strategies [?]. MAP is grounded in the Elaboration Likelihood Model that can select different persuasion strategies based on persuadee's feedback. With an evaluation of 26 elderly subjects, the result shows a MAP-based agents can change persuadee's attitude intentionally [?]. However, the existing framework cannot personalize for persuadee's profile and existing beliefs. And the framework can only accounts for a limited number of persuasive strategies.

However, four challenges have not been addressed in the current state of knowledge in building computational persuasion system, including insufficient domain knowledge, constrained persuasion protocols, unrepresentative persuadee models and lack of optimal persuasion strategies[?]. An effective computational persuasion model requires sufficient formalize domain knowledge about persuadee goals, persuade preference, and system action base etc to generate related persuasive arguments; an effective persuasion protocol that can best leverage the constrain of the media and deliver generated persuasive messages efficiently; representative persuade model that allows the persuasion system to optimize a persuasion model algorithmically based on persuadee's beliefs and preferences; effective persua-

sion strategies that harness the perusadee model and produce optimal moves to persuade [?].

In our study, we focused on persuasion protocols and persuasion strategies. On one hand, we developed a persuasive framework can automatically generate persuasive messages in the comics form which provides a novel persuasion protocol that can be adapted in an computational persuasion system. Our comic-based persuasion protocols can produce individualized persuasive comics based on perusadee's model in terms of the text content, figure gestures and background shading. On the other hand, our experiment results suggest a unique persuasive strategy which leverage the text framing and visual comics representation.

Persuasion Through Comics

The simple and humorous nature of comic makes comics becomes an unique media for delivering informative and memorable messages. While reading comics book is commonly recognized as entertaining, comics have been examined as an effective way of communicating abstract ideas to broad audiences [?, ?, ?]. McDermott et. al used comics to illustrate complex scientific facts [?]. In education, comics have been used and examined as an effective tool for reaching different populations with various background [?, ?, ?]. Meanwhile, the common usage of metaphor in comics can make the underlying meaning for vivid and therefore more memorable, which is core in persuasion, than using a straightforward description [?, ?]. Moreover, comics can contain persuaee's personal story which is incredibly powerful in persuasion[?]. With personal story, comics can express emotion and create empathy for readers. Matsubara et al. showed that there is a link between comic's content and the emotions felt by the readers [?]. Thus, in the form of comics, complex messages can be easily interpreted and memorized. Given the advantage of using comics to deliver meanings, our study took one step further and considered the persuasive side of comic representation.

However, using comics to persuade is challenging. First, generating comics is not easy. Especially, persuasive messages are better to be personalized to deliver maximum persuasive power. Traditionally, comics are created by professional cartoonists which is very costly to produce personalized comics. Although prior work has explored methods of algorithmically generating comics, no existing method is for generating persuasive comics.

METHOD

In this study, we composed persuasive messages in both plain text and comic representations to compare the difference in their persuasive power and potential elements in the comics that may influence the persuasiveness. The main goal of all messages are the same, persuading readers to engage more exercise. The main reason to choose this goal are 1) As a basic daily activity everyone has the need to exercise. 2) People can easily understand the message and relate to themselves. 3) Engaging more exercise is mostly based on audience own willingness instead of any other subjective resources.

Composing Persuasive Messages in Plain Text

Borrowing the idea from Psychology and Behavioral Economics, the key persuasive technique we adopted here is implying social norm through the messages (e.g. how participant's friends are doing). Also, we incorporate the idea from Tversky and Kahneman that people will be influenced differently if the same message is framed as risk averse or risk taking. Therefore, we created two sets of messages that either framed from a positive standpoint or a negative standpoint.

The followings messages were presented in our study.

Positive framed messages:

1. In the past week, you spent more time at the gym than did 65% of your friends
2. Congrats! You have reached your goal of exercising three times a week.
3. Over the past month, you exercised more than did 90% of your friends.
4. Your exercise activity is in the top 20% of all your friends.
5. Over the past three weeks, you went to the gym more often than 60% of your friends did.

Negative framed messages:

1. In the past week, you spent less time at the gym than did 65% of your friends
2. Congrats! You did not reach your goal of exercising three times a week.
3. Over the past month, you exercised less than did 90% of your friends.
4. Your exercise activity is in the bottom 20% of all your friends.
5. Over the past three weeks, you went to the gym less often than 60% of your friends did.

Communicating through Comics

As a form of art, the creation of comics has few limitations. Although there is no common template that could describe all comics, if we take a closer look at each comic, it is not hard to see that every comic consists of several fundamental components. We categorize these comic elements into different groups:

1. characters,
2. gesture,
3. background color/shading,
4. word bubble,

In this study, to represent persuasive messages in a comic form, we need to determine each of those four parameters.

As Scott McCloud mentioned, the reader is more likely to project him/herself onto the character in the comic when the comic getting abstract [citation]. By taking the perspective of the character, the reader will internalize the information his/her character trying to express or receive. If the information is persuasive, the internalization will imply a higher chance of expected behavior change. Therefore, in this study, we choose to use an abstract yet well-recognized comic style, the xkcd style created by Randall Munroe, in our generated persuasive comic messages.

Beside the abstractness of the character, we believe the relationship between characters is also important. In real world, previous research suggests that messages are more persuasive if the person communicating the ideas is someone the receiver related [citation]. People are more likely to believe their close friends than strangers [citation]. In abstract comics, the relationship between characters is usually modeled by the distance between characters [citation]. So, it is reasonable to believe the link still holds in the world of comics as the reader tends to project his/herself onto the character. Therefore, we hypothesized that the distance between characters in a comic may influence the persuasive power.

The gesture of a character is another important component in the comic. The gesture of a character can help reader to understand what happens and the emotion of the character. Different gestures also imply the intensity of an emotion. As a common technique, cartoonists often use the gesture to intensify the feeling that they want to express to the reader. For a persuasive message, the intensified emotion may make the message more memorable than a plain tone. Thus, in this study, the gesture is another key element that we believe may moderate the effectiveness of a comic message.

A rich body of research has demonstrated the relationship between color or background shading and the emotion. In comics, the color of elements or the background shading contributes significantly to the feelings as well. However, as xkcd style are mostly seen in black and white, we suspect and confirmed in our pilot study that color background does not go well with generated comics (see pilot test 1). In the main study, we only manipulate the background shading in gray scale to show its affect on the persuasiveness.

The word bubble is the most common place in comics to incorporate text information. In a persuasive comic, the word bubble expresses the text content of the message.

Generating Comics

In this study, we create a based template for all comic messages that includes two characters in a conversation and the scenario is 'One day, your friend has something to tell you.'

We developed an algorithmic comic generator that based on Comix I/O, an open source project that creates comics with stick figures using HTML markup. To maximizing the flexibility, we further developed the existing build with Canvas and rough.js. The generator allows us to create the comic representation of a persuasive message with variations in character's gesture, inter-character distance and background shading.

For gesture, we created the gesture library in a JSON format with two main categories: positive and negative corresponding to how the original message is framed, each with three levels of intensity.

For the distance between two character, we have three levels of variance from close to far as well. The three level of distance represents the relationship between to characters as close friends, friends, acquaintance, from close to far.

For the background shading, we have a total of three levels from white to dark grey. Each level represents a level of emotional intensity, white as lowest.

To make a fair comparison between plain text representation and the comic form, the content of text information is the same in both conditions.

In total, for each message we have a total of 27 variations in terms of character gesture, inter-character, and background shading. In this study, 270 comics was created corresponding to 10 plain text messages.

Study Design

To test our hypotheses, we designed and conducted a between-subject field study through Amazon Mechanical Turk. In the experiment, participants will see a total of five persuasive messages in both plain-text form and comic form side by side. Then, the participant will be asked which form of the message is perceived as more persuasive and how persuasive is it.

Once participants agreed to join our study, they will be randomly assigned to two conditions 1) positive message condition where all persuasive messages are framed in a positive way and 2) negative condition where all persuasive messages are framed in a negative way. In both condition, Participants will compare five persuasive messages.

For each persuasive message, the participant will compare the same message in plain text and in a comic form on a 7 item Likert scale.

Display Order To mitigate any potential bias toward the display order of the plain-text representation and comic-style representation. The display order is randomly assigned. Both plain-text representation and comic-style representation have equal chance to be displayed first on the left side.

Attention Checker To control the data quality, we embedded two attention checkers in the experiment. The first one appears after the third comparison and the second one shows up after the last comparison. Both attention checkers asked subjects to choose a comic that matches a simple description, e.g. "Which of the following comics has two characters?"

Rating Scale Design. The 7 item Likert scale is ranging from -3 (left) to 3 (right) where 0 means neutral. The direction of the scale flips corresponding to the position of the comic and plain text.

Pilot Tests on the Study Design

Before the actual experiment, we first tested our design in a small scale. We deployed our study on Amazon Mechanical Turk and received total of 10 feedbacks in 5 hours. Surprisingly, 5 of 10 participants reports the scale is confusing. 3 of them reports the flipping scale makes they spend more time on figuring out which side is which. One participants said "When I am answering my last question, I suddenly noticed the scale is different. I noticed the order of text and graph is changing but never notice the scale is changing as well. "That's really confusing!!"

Based on the valuable feedback from our pilot test, we reiterated our study design. In the final design, we fixed the order of the rating scale. However, since the order is fixed, potential demand characteristics may be introduced by the scale, e.g. the researcher may want me to choose the larger number or items on the right/left side is expected. To minimize potential biases, in our final design, another layer of randomness was added. The direction of the scale no longer changes respect to the position of the messages, but the direction of the scale is randomly assigned for each participant. Also, the number on the scale is replaced by text as neutral, slightly persuasive, text/comics is more persuasive and strongly persuasive.

Participants

We published our HITs on Amazon Mechanical Turk titled with "A short survey about your exercise motivation". The price tag for each HIT was \$0.50, which were the rewards the workers would get regardless of their performance. The threshold for participant to join our study is a 95% Approval Rate. On the HIT page, participants would see a link to our experiment site and a text input box for them to enter a six-digit completion code. Repeated worker will be rejected as we instructed in the task description.

RESULTS

Raw Data

In this section we describe the raw data counts, the number of participants, the number of people whose responses we dropped. The final number of observations

Analysis

We use a Bayesian formulation of the problem of identifying suitable predictors for the comic form. The appropriateness of use of Bayesian analysis for the HCI community have been discussed at length elsewhere; see [?] for an excellent introduction.

Formally:

$$z = \beta_0 + \sum_{i=1}^k \beta_i x_i \quad (1)$$

$$\beta_0 \sim N(\mu_0, \sigma_0) \quad (2)$$

$$\mu_0 \sim N((1+L)/2, L^2) \quad (3)$$

$$\sigma_0 \sim U(a, b) \quad (4)$$

$$\beta_i \sim N(\mu_i, \sigma_i) \quad (5)$$

$$\mu_i \sim N(0, L^2) \quad (6)$$

$$\sigma_i \sim U(a, b) \quad (7)$$

DISCUSSION

REFERENCES