

Narrating Climate Change: speculative data stories in comic form for affecting climate action

Zijing Song, Yating Sun, RAY LC

City University of Hong Kong School of Creative Media, Hong Kong, Hong Kong SAR

Academy of Art University, San Francisco, USA

LC@raylc.org

Abstract

Climate change is difficult to rationalize due to it being remote in both its effects and in where it operates. Using purely physical arguments like statistics and policy debates cannot persuade people to the side of climate change action, because explicit mandates don't align people's own intrinsic motives with those of climate action. Instead, narratives and visual communication can influence viewers implicitly by the way they show and reinforce actions and ways of thinking that align with climate action. In this study we created comics designed on the human level to promote ideas like future-based thinking, sharing of responsibility, and caring for each other, as well as data visualizations that illustrate future consequences of climate change for the purpose of averting negative alternative realities. We test these strategies on readers unfamiliar with the theme of the stories, reading them as common manga about characters and situations. We then surveyed these readers to find that data stories can affect the way they interpret narratives to align with pro-climate attitudes such as sharing and future-vision, and that readers are focused on the human-level of the data and story as opposed to the physical resource level. Thus speculative data provides a way to influence individuals' climate change attitudes by showing alternative realities and positive attributes of collective responsibility and planning-for-the-future in data story form.

Keywords: design fiction; data comics; climate action; data visualization; data narratives.

Introduction

Climate change is a major crisis of our generation. However, people often regard climate change as remote and impersonal (Leiserowitz 2006; Weber 2006), and far from the way we experience reality. Changing the mindset of non-scientific communities and climate change skeptics are difficult due to ingrained beliefs of skeptics and the attribution of climate change to hearsay and political rhetoric. Climate communication strategies that use more personal strategies like storytelling and visual communication are needed to develop pro-environmental behaviors and attitudes (Boykoff 2019). These long-term behaviors for social good need to activate intrinsic motivations, which can develop when experiencing narratives aligned with particular social purposes (LC and Mizuno 2021). We apply a novel genre of data comics (Bach et al. 2017) which combines speculative story design (Dunne and Raby, 2013) and data visualization in the form of comics to generate an appealing and persuasive climate action narration.

On the physical level, climate change involves a set of phenomena like consumption, natural resource limitations, increases in population, and lack of policies in sustainability. These issues are not addressed here because directly imposing evidence and scientific facts on the public is not effective for behavioral change (Pawlik, 1991) due to their essentially extrinsic motives. Rather, we intend to tackle the human level, addressing phenomena like immediate gratification, human myopia, taking comfort in ignorance, belief in lack of individual influence, and desensitized negative outcomes. To promote

long-term behaviors that align with climate awareness using visual communication, we use the medium of the comic, which has broad appeal to capture even climate skeptic's attention without appearing to preach about climate change. We use data communication methods embedded in the comic to diffuse the difficulty of the topic and reduce the negative reaction to scientific content, using speculative data visualization to narrate possible realities designed to provoke thinking about consequences of individual actions and alignment of intrinsic motivations with social goals for positive climate action.

Background

2.1 Design fiction as climate communication

Design fiction is a strategy for narrating potential futures by varying a particular premise (Blythe 2017), considering potential futures within social and cultural narratives (Bleecker 2009). Design fiction can provide a narrative strategy for social influence by showing the effects of alternative visions (Moezzi, Janda, and Rotmann 2017). Evidence suggests that narratives can strengthen the attitude-behavior relationship (Rhodes, Toole, and Arpan 2016), so reading climate fiction may help activate pro-environmental behavior in individuals who already have strong pro-environmental attitudes. Moser (2016) showed that climate fiction leads to greater public comprehension of negative consequences caused by climate changes compared with reading about research. However, unlike Moser, Jones (2014) pointed that there is no strong evidence to show climate storytelling is more persuasive than communicating evidences in real life. They do not account, however, for fiction purposely designed for *positive* persuasion for actions that can contribute to positive climate action as opposed to seeing negative effects of climate change.

2.2 Comics and visualisation in climate communication

In scientific communication, illustrations play significant roles as visual explanations (Schreiner 1997) that reflect the structure of the

concept presented (Farinella 2018). Such visual communication, reflected in the comic, has the potential to convey the complexity of reality despite being accessible to the public (Darnhofer 2018). Comics can engage wider audiences with its visual and character-driven approaches (Farinella 2018). Moreover they support contextual storytelling based on aspect transitions that convey mood and sense of place, allowing for implicit influence through environmental design as opposed to explicit forms of narrative influence (McCloud 1994). Influence through contextual and graphical means avoids the explicit argumentation that doom climate change discussions to failure.

2.3 Speculative data visualization and data comics

Researchers in diverse fields have become interested in how to create data visualization and affect viewers' attitudes (Sheppard 2005; Kim and DiSalvo 2010; Ballantyne 2018). Speculative visualization has the potential to combine data visualization and graphic design to show data in a meaningful and intelligible way while being accessible to the general public (Kim and DiSalvo 2010). Since viewers may reimagine thought-provoking questions through visual examination, the data we present becomes "stories" used to influence public awareness (Kim and DiSalvo 2010). Therefore, combining the influences of design fiction and data visualization may create more effective climate change communication in a narratively persuasive form.

To effectively achieve data visualization and engage viewers in decoding messages and making informed decisions beyond the limitations of complexity of data and visualizations, more recent attention has focused on the novel genre of data comics (Bach et al. 2018). It utilizes the narrative concepts and visual information of traditional comics to express data-related insights through visualizations designed to communicate complex, usually scientific ideas (Wang, Dingwall, and Bach 2019; Bach et al. 2018). We develop the use of data comics to express the narrative aspects of identifying with climate action, transferring traditional patterns of

infographics presentation to narrative forms for particular social purposes.

Narrative Design

3.1 Story and headline writing

We begin by specifying particular design purposes for climate change action. These are not physical resource arguments like overconsumption or resource destruction, but rather human phenomena that we believe are the central cause of the climate catastrophe. These include immediate gratification, myopia, the idea that an individual's effect doesn't matter, comfort in ignorance, etc. Since this research aims to reach general audiences and audiences who may be climate change skeptics, climate issues are not directly mentioned in the stories. The work may be read covertly as simple a comic rather than a form of climate fiction. The titles of the stories also reflect subtle cues such as *Redemption Park*, *New Revolia*, and *Every Flash of Light Is the Sun of Another World*, all of which evoke themes of rebirth, community responsibility, and learning from an experience.

3.2 Comic design

We designed five stories to address different human phenomena propagating climate change. For example, one story is *Sonia McDougal*, based on the story structure of “Rebirth” (Booker, 2004) and designed to dispel the idea of maximizing immediate gains over future considerations. It tells the story of a shoe business entrepreneur named Sonia who must make a decision about her company, whether to invest in long term research and development, or to push the product widely to the general public. In her personal life she takes the approach of immediate needs and gratification, as opposed to settling down. Then after choosing to maximize profit in her professional life, the business fails, teaching Sonia an important lesson in the “Rebirth” theme. She realizes she should consider a long-term plan and decides to take action in her personal life, to finally settle down with her boyfriend. The illustration uses a science fiction comic book style which is more to show the story theme: the yet-to-be-produced shoe which works in

any weather and can predict the rain using electronics. The science fiction look subtly points out a future-directed theme in comic design, which is espousing future-directed over immediate-directed lifestyles.

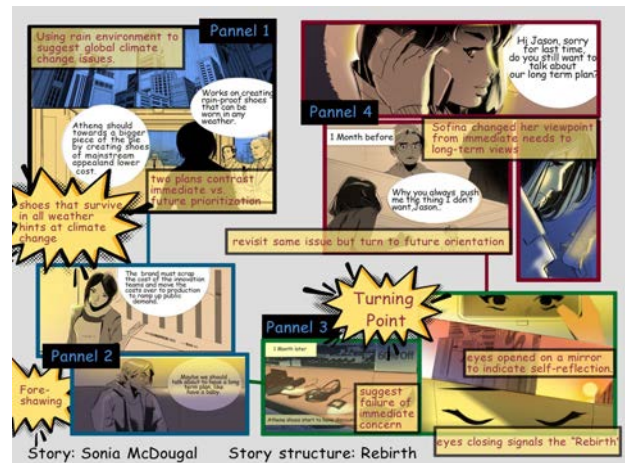


Fig 1. Persuasion through visual design in Sonia McDougal.

Other subtle cues abound in the visual comic. For example, to show the research and development that involves experimental shoes that survive in all weather, we designed a rain motif found in several scenes in the story. To show the the turning point in Sonia’s life after the business failure, we showed eyes opened on a mirror to indicate self-reflection, then the shoe business building in a diagonal position to indicate failing, followed by eyes closing, which signals the “Rebirth” structure that also hope to change the audience’s own viewpoint from immediate needs to long-term views. These moments establish the change undergone by the character using aspect transitions as a way to apply environmental storytelling to the work (McCloud 1994). The “Rebirth” theme is emphasized in the recurrent scene structures during Sonia’s two encounters with her boyfriend.



Fig 2. Contextual storytelling by visual design in New Revolia.

3.3 Data visualization in comic

According to Bach et al. (Bach et al. 2017), there are four significant elements in data comics: visualization, flow, narration, words and pictures. In Sonia McDougal, one panel with a graph was added to show the increase in randomness of day-to-day rainfall, which is used to support the idea of research and development for future gains of the company in order to create smart rain-proof shoes (Fig 4). To keep the balance between data and context in our work while pushing forward the narrative (Bach et al. 2018), a distribution map on typhoon incidence in current and future times was given in the storytelling line. Note that these are not real data, but rather attempts to tell the story of future situations using data as narrative. Hence the speculative data story approach develops a hypothetical view of the world that then allows the reader to extrapolate about the consequences of following the direction of the main character in prioritizing current over future considerations.



Fig 3. Using data visualization to describe future scenarios in the context of the narrative in Sonia McDougal.

Since comics have the advantage of splitting complex processes into less complex sections for easy understanding (Bach et al. 2018), it allows viewers to follow complex relationships and scientific ideas. Two panels in New Revolia are examples. First, a graphic map implicitly explains the main reason for the shipwreck - the melt of glaciers caused by global warming. In the following turning point, a heated discussion about the social values among two groups of characters (scientists and bunnies man) occurred and one scientist put forward a reasonable solution to distribute food equally. Then, the food distribution plan is visualized using graphics that not only indicate the idea of the plan, but also uses the form of the data graph in showing people and their carbon footprint to narrate the idea of sharing of responsibility in the context of the story.

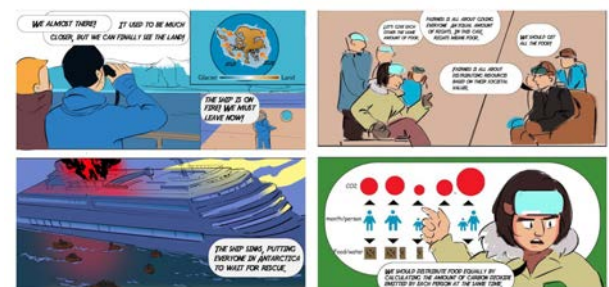


Fig 4. Using data visualization in New Revolia to describe strategies for sharing carbon emission responsibilities..

3.4 Magazine layout

Since this design object intends to have subtle influence on climate change skeptics, it is presented as a magazine-formatted tabloid, to design for the idea that climate change skeptics tend to read sensational newsmagazines. The comic is printed on A4 size (210mm×297mm) newsprint and full-page layout, including 12

pages and 5 stories (*Sonia McDougal, Redemption Park, VO, Every Flash of Light Is the Sun of Another World, New Revolia*). All the fronts of text and elements follow comic-drawing style. In order to help readers easily understand the content and panels, the designers set the layout according to the "Z-path", from left to right and downward, which is preferred by new comic readers (Cohn 2013). Since the different visual emphases to page layout and panel composition have the potential to improve the dramatic effects of a story or plot, the character panels in every story are zoomed out and emphasized to help the development of storytelling.

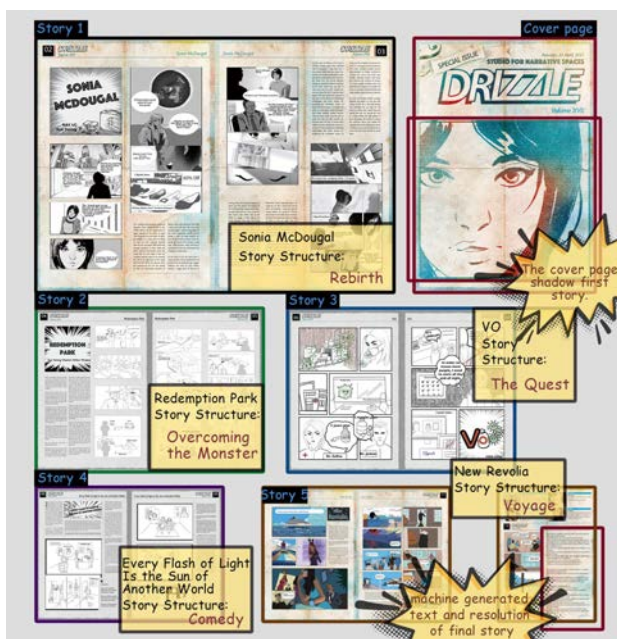


Fig 5. Layout of Drizzle and design purpose for each story.

4. Methods

Inspired by climate communication based on narrative and data visualization strategies, we aimed to investigate how people interpret two climate comics designed to influence interpretation leading to alignment with pro-climate action:

RQ1: Does speculative data comics have potential to improve the audience's climate change awareness and lead to climate friendly actions? If so, how does this process occur at the level of particular story and data designs?

RQ2: What can we learn from the way people interpret data comics designed to influence pro-climate action, in order to create effective climate action communication?

Online surveys are conducted to evaluate the influences and effectiveness of these comics. The questionnaire was divided into 5 sections: demographic Information, reactions to Sonia McDougal and New Revolia, the purposes of comics, self report of climate attitudes, and a donation game. First, we collected demographic information of participants (including age groups, gender and educational background) to be sure we get a range of different backgrounds. After that, participants were asked to read the two comics and answer several questions related to their understanding and feelings about story plots, story structures, painting styles, layout, characters, data visuals and environment graphics. Here, we ask people to interpret the comics purely on what the stories they tell and the data it visualizes, without mentioning the climate action purpose of comics. In section 3, we evaluate the effectiveness of the comics and how readers interpret them in context of climate change. Then, based on a relevant survey measuring positive environmental change awareness and intentions (Christensen and Knezek 2015), we created a self-efficacy scale about climate change attitude to measure how pro-climate each reader is. Finally, we tested participants' climate action via a question about donation: "Suppose that you receive \$20 as salary after completing this questionnaire, and you can choose to donate this money to a climate protection organization. How much would you like to donate out of the \$20?"

The questionnaire was made and distributed in the Google survey form. Participants were recruited and paid through an online research participants recruitment platform - Prolific (n=43, 15 male, 27 female, 1 non-binary). We used R 4.0.3 and RStudio 1.3 to process, analyze, and plot the data. The participants' short responses to questions about interpretation of particular aspects of the story were then qualitatively coded and analyzed.

5. Findings and discussion

5.1 Quantitative results.

In general, participants reported being quite positive about the way the design of stories and data visuals contributed to learning about climate change. Moreover in the Sonia McDougal story, there's a significant difference between the way people perceived the climate change purpose as opposed to the edification over physical resource level (Wilcoxon, $p=0.00306$), indicating that the story design led readers to consider the idea of future-directed thinking (the core theme of the story) more than the physical aspects of climate change.

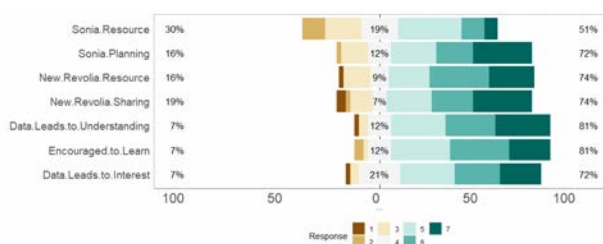


Fig 6. Quantitative data from survey. Sonia.Resource - “How strongly does the Sonia McDougal story contribute to an understanding of development of resources?” Sonia.Planning - “How strongly does the Sonia McDougal story contribute to an understanding of prioritizing long term planning?” New.Revolia.Resource - “How strongly does the New Revolia story contribute to an understanding of resource limitations?” New.Revolia.Sharing - “How strongly does the New Revolia story contribute to an understanding of sharing amongst diverse groups?” Data.Leads.to.Understanding - “How much do you think the four panels with specific climate change data and facts helps you realize the urgent situation of climate change?” Encouraged.to.Learn - “How encouraged are you to learn about well-supported data about climate change?” Data.Leads.to.Interest - “How strongly do you think this data in comic contributes to your interest in climate change evidence?”

However this positivity about climate change can be due to the self-reported support of climate change, for the climate change attitude scale revealed a general agreement of over 80% above 4 (1-7 scale) in every question in the survey, e.g. “How strongly do you believe the facts and data of climate change?,” “How strongly do you agree climate change will impact future generations?,” etc. (Christensen and Knezek 2015) This indicates that readers already report highly on pro-climate attitudes, and hence the story may not be tested against a population that are climate change skeptics.

We also do not see a significant correlation between the median pro-climate rating in the

attitude survey with the donation amount ($R=0.245$, linear least squares), meaning that the donation assay was not useful for establishing whether participants were pro-climate action.

5.2 Qualitative feedback.

Reactions to data comics: When asking about the story based questions (including individual reactions to specific story plots, graphs, the decisions of characters, future development of stories etc.), participants obtained a better understanding based on data visualization (including visual symbols, colours, shapes and sizes). In Particular, they mentioned the benefits of data visualization for adding credibility and acceptability to narrations in comics.

“The smaller you are, the less you give and should take.” -P3

“The graph is simple, but it adds credibility to the comic.” - P14

“Food given based on how much each person will contribute to CO2 emission, so they are trying to minimise emission.” - P17

“Easy to understand. The shapes of the circles are in different sizes depending on the person, and that's the amount of resources they should get in "box quantities.” - P18

“The first graph supports Sonia's statement that weather has been unpredictable, but also shows a level increase in the amount of rainfall. The second image shows how the weather patterns shown in the first image have developed into storms.” - P44

However, some participants may reconsider the rationality of stories based on the accuracy of data shown in comics. Thus, designers should be more cautious in selecting and presenting reliable and scientific data in the storytelling context if they are used to persuading traditional argument strategies. For instance, several responses queried the fairness of the distribution plan shown in the graph based on personal understanding and reflection.

“The figures don't involve any specific gender.” - P36

“They use pseudo science environmental charts.” -P33

“Not very scientific.” -P44

This underscores the lack of understanding about speculative story design. Readers may be assuming graphs to tell truths even when they give hypothetical scenarios the extrapolates based on current climate change understanding.

Personal perceptions about climate action purpose: Responses from participants who already have good climate awareness suggested that data comics is a more engaging and provoking form for viewers. (P44: *“I am already well informed on the subject but it definitely engaged my interest and I found it very thought provoking.”*) However, several participants mentioned that data may become exaggerated and fictitious during the process of visualization. (P6: *“The data in the comics is more fictional than the scientific data.”*; P8: *“The comic maybe present some exaggeration due to impact in the viewer, and also add some color and shapes.”*) Although participants may feel confused about the accuracy of data in comics and fictional stories, they still preferred data comics as a creative climate change communication. (P14: *“The data from the comic is very generalized and imprecise, but it is expressive and attracts the reader's attention.”*)

Limitations of data comics: Based on the analysis of participants' willingness to adopt pro-climate change actions, a limitation of data comics was the length of stories. Participants emphasized the significance of the length of story lines which can make audiences immersive in the story's environment.

“The comics were too short to provoke a catharsis.” -P16

“...longer story lines to take one on a journey.” -P10

On the other hand, participants also pointed out that they realized the urgency of climate change

not only from reading these climate action comics. (P36: *“Not from the comic alone.”*) To further support the effectiveness of data visualization in climate comics, designers should think more about the connections between narrations and specific situations in reality which may enable users to take pro-climate change behaviors. (P14: *“It is important to show specific situations with which the reader can identify and imagine himself in the future.”*)

6. Conclusions

In this research we explored how speculative data comics can be designed to enable climate change awareness and nudge audiences to take pro-environment behaviors in a visually appealing and intelligible way. We designed and distributed *Drizzle*, a comic magazine that has the covert purpose of climate action without advertising itself as about climate change. We then evaluated the way the comic stories can narratively persuade readers in regards to climate action. Quantitative data showed that participants were more likely to focus on the theme of future-thinking in a story as opposed to physical issues like resource limitations. Although several participants felt confused about the rationality and accuracy of data comics and fictional stories, the majority of them still reported positive influences in climate awareness and alignment with positive climate action goals. However, the majority of our participants reported having a pro-environment perspective. This suggests that to better evaluate our design, we should look for groups more antagonistic to climate action to better evaluate the implicit effects of narratives and speculative data on climate change attitudes.

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