Designing for Narrative Influence:
speculative storytelling for social good in times of public health and climate crises

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Health and safety concerns have led to policies that put individuals under lockdown, but such restrictions lose effectiveness in the long-term due to inherent human needs of connection and physical action. People maintain prosocial behaviors long-term only if they make decisions themselves intrinsically as opposed to forced restrictions. To build systems for effecting positive social purpose in pandemic and environmental concerns, we apply speculative design to create story structures and interactions that promote behaviors for social good. We designed stories and interactions using both plot-based narrative frameworks and character-based machine-learning-generated dialogues for effecting cooperation. We then ran a series of workshops investigating how designers negotiate and collaborate to tell stories for social purpose using a "finish each other's stories" approach. This work illustrates the application of design fiction to promote sustainable behavioral patterns that value societal good.

CCS CONCEPTS • Human-centered computing • Interaction design processes and methods • Scenario-based design

Additional Keywords and Phrases: social influence, design fiction, intrinsic motivation, public good, machine text.

1 INTRODUCTION

Behaviors that promote social good, such as wearing masks and social distancing, recycling, decreasing consumption for climate change are difficult to adhere to. For example, observing social distancing during covid-19 is difficult to maintain because these policies rely on extrinsic motivation [16]. Long term results require instead an intrinsically motivated approach to promote prosocial actions. One powerful intrinsically rewarding strategy involves the use of narratives to motivate a sense of purpose and provide implicit sources of information about norms and contexts.

In this study, we take three approaches to using narratives for social purpose. First, we designed story templates and used plot elements to drive narratives that imply themes of positive social behavior. We used a theatrical medium as in TV and fiction, as well as an interactive medium involving the participant as a player in a messenger-based game. Second, we used a machine learning natural language model trained on corpuses of texts like the novel, twitter, youtube, and private messages to generate prosocial snippets that tell a short story persuading the user to act for prosocial purposes. Third, to mimic real-world situations of collaborative story design, we held a series of workshops that asked participants to design narratives for the purposes of positive action for climate change, epidemics, recycling, and population growth. We gathered data on how designers negotiate story purposes together as they attempt to finish each other's stories.

2 BACKGROUND

Health and safety measures during the pandemic rely on lockdown strategies, which although effective for reducing spread of infection [1], cause psychological and physiological tolls that lead to inability to maintain such restrictions

long term [12]. Isolation-induced psychological symptoms like loneliness [25], depression, post-traumatic stress [19], anger [32], increased domestic violence [8], and suicide [37] make the price for health and safety outcomes unbearable. Combined with physiological tolls like increased cardiovascular risks [10], physical inactivity [35], reduced immunity [38], diabetes, cancer, and kidney disease [41], prolonged isolation is difficult to maintain for human long-term viability.

Moreover, healthy habits are difficult to form due to motivation being extrinsically driven and to human bias towards immediate concerns [20]. In addition, optimism biases lead us to disregard for previously enacted public health measures, while omission biases explains unwillingness to adopt measures like vaccination [22]. Such biases make sustainable changes in behavior difficult [30]. How can policies affecting public health and the environment be implemented in an intrinsically motivating, sustainable, and prosocial manner, despite the limitations of human biases and unreliability?

2.1   Social Influence and Misinformation

One approach is to apply social influence and social norms to affect behavioral change. Strategies like providing needed information, creating social incentives through norms, and giving recommendations and cues for action have been applied to positively influence health-promoting behaviors [11]. However these strategies do not appear to affect behavioral intentions that relate to public health like wearing a mask [31]. Moreover, strategies based only on social norms and information delivery are dependent on the quantity of behaviors taken [27], making it difficult to match intentions to actual behavior output. Norms are highly dependent on framing, so that both sides of an issue can be used to convince the other [34], leading to perceived extrinsically motivated policy debate rather than intrinsically motivated actions when a consensus is not reached. Social norms can work in the other direction as well, as social groups that gather to oppose regulation can form to advocate individual actions *against* public health and other agendas [18].

The difficulty with applying social influence alone is that there's a clear agenda that leads people to react against the perceived attempt to manipulate. The threat of misinformation in unregulated outlets like social media has grown steadily, despite attempts by platforms to limit their spread [2]. The propagation of unvetted health misinformation is dangerous, as it spreads by personal curation that takes a single person's common sense over scientific evidence, and corroborates the lack of confidence in a nation's medical system [13]. Studies have found that propagation of credible info like scientific results is difficult to distinguish from misinformation like conspiracy theories on social networks [15], suggesting that providing data to people alone cannot persuade them to a credible degree over sources of misinformation rampant in our society. As election history has shown, propagation of disinformation has been used to persuade voters in decision making processes [17], turning questions of public good into bickering and debate about control. Arguing in favor of intrinsic motivation, one study showed that electoral participation was not increased by offering extrinsically motivated rewards [33]. The issues of trust and misinformation also apply to AI systems, prompting more work in using scenario-based design to create explainable AI systems [40]. This research shows that narratives can allow nonexperts to understand AI systems by metaphors and points-of-view that relate complexity in machines directly to us [24].

2.2   Storytelling as Implicit Influence

How can we increase intrinsic motivation for social-positive behaviors? We identified the power of storytelling-driven approaches to change intrinsic motives. This strategy is seen in cults and prisoner-of-war camps. One of the ways cults obtain compliance is through iterative enclosure, getting prospective members away from protective forces like friends and family [36]. This produces an environment conducive to framing stories of us vs. them, and provides a perspective that slowly propagates changing attitudes. Story-writing tactics were employed to subvert beliefs in POW camps. Allied prisoners were first asked to name one thing good about Communist regimes [4]. Next, they could write letters home

about how Communist life was superior in exchange for mail-receiving privileges. These extrinsically motivated (receiving goods) tasks are converted into intrinsic beliefs (Communism is right) by repeated framing and story-writing by the POWs. Storytelling is a powerful tool for changing behaviors and beliefs under unrelenting circumstances.

To step away from policy debate and into designing for purposive action motivated by intrinsic motives, we propose the use of narrative strategies to create artifacts and interactions that enable public interventions for social good. Instead of arguing over policy, we rely on negotiation for narrative purpose. Instead of debating merits of strategies for achieving a goal, we engage in collaborative design for that goal, using the designed artifact to generate interest instead of apathy.

2.3   Speculative Design of Narratives

The field of Speculative and Critical Design (SCD) employs two narrative types: 1. Juvenarian satire that works through narrative techniques of antithesis, obscenity, and violence, and 2. Horatian satire that works through burlesque, colloquialism, exaggeration, and anticlimax [29]. Juvenalian satire, in particular, evoke contempt, shock, and righteous indignation in the mind of the audience as narration. HCI communities have also used storytelling as an ethnographically researched narrative of a user. Some have argued that solutionism-based research without consideration of implications leads to ethical debates in design anthropology [6]. To challenge this, fictional abstracts have been proposed to function as transparent examinations of ethical issues in HCI studies and stimulate discussion in speculative space [28].

Storytelling is the fundamental way humans communicate decisions and behaviors. Narratives are applied to design of interactive systems to frame questions, propose solutions, evaluate alternatives, and consider possibilities [3,5].

In this work, we first design narratives that promulgate a particular social goal without explicitly persuading readers. We framed these narratives as archetypes without tying them to particular media such as movies, novels, songs, radio shows, apps, games, or websites. Second, we designed interactions with narratives that promote public good. To provide generalizable narratives on demand, we used an unsupervised language model to generate text based on purposes espoused, using different media like twitter posts, novels, youtube transcripts, and text messages for each purpose. Third, to investigate how designers could use storytelling to design for purpose collaboratively, analogous to real-world situations, we ran a series of design workshops that attempted to tease apart which story structures are useful for different storytelling purposes and investigate how designers work with each other to negotiate a narrative-based design.

3   NARRATIVES FOR SOCIAL GOOD

Taking the case of public health and safety, we set out to design templates for stories whose purpose is to show that "Recklessness Leads to Heartache," encouraging pro-social behaviors that minimize the spread of disease. This hands-on exercise led to detailed examination of plot and character considerations that affect the power of influence of the story. The first story we created (Figure 1) is designed for theatrical media like novels, films, and news, encouraging the virtues of consistency and responsibility in its audience with the reward of well-being and happiness. In the spectrum of plot vs. characterization, it veers towards the plot as a way of driving the action, because in encouraging behaviors for public good, the individual characterization is reduced in favor of elements in society beyond the character's control. This reliance on society leads to environmental story-telling favoring plot-based action. The second story uses an interactive format where audiences can play a game that mimics real-life message-chatting while acting as the main character. We vary only the specific characters and content without changing the underlying plot template. The second story is told by interacting agents like a message chat with machine-generated persuasive text, so that character development is revealed through interaction with other characters, a style we call "polyphonic" as each character tells her own story. These two stories serve as variations on the same narrative template.
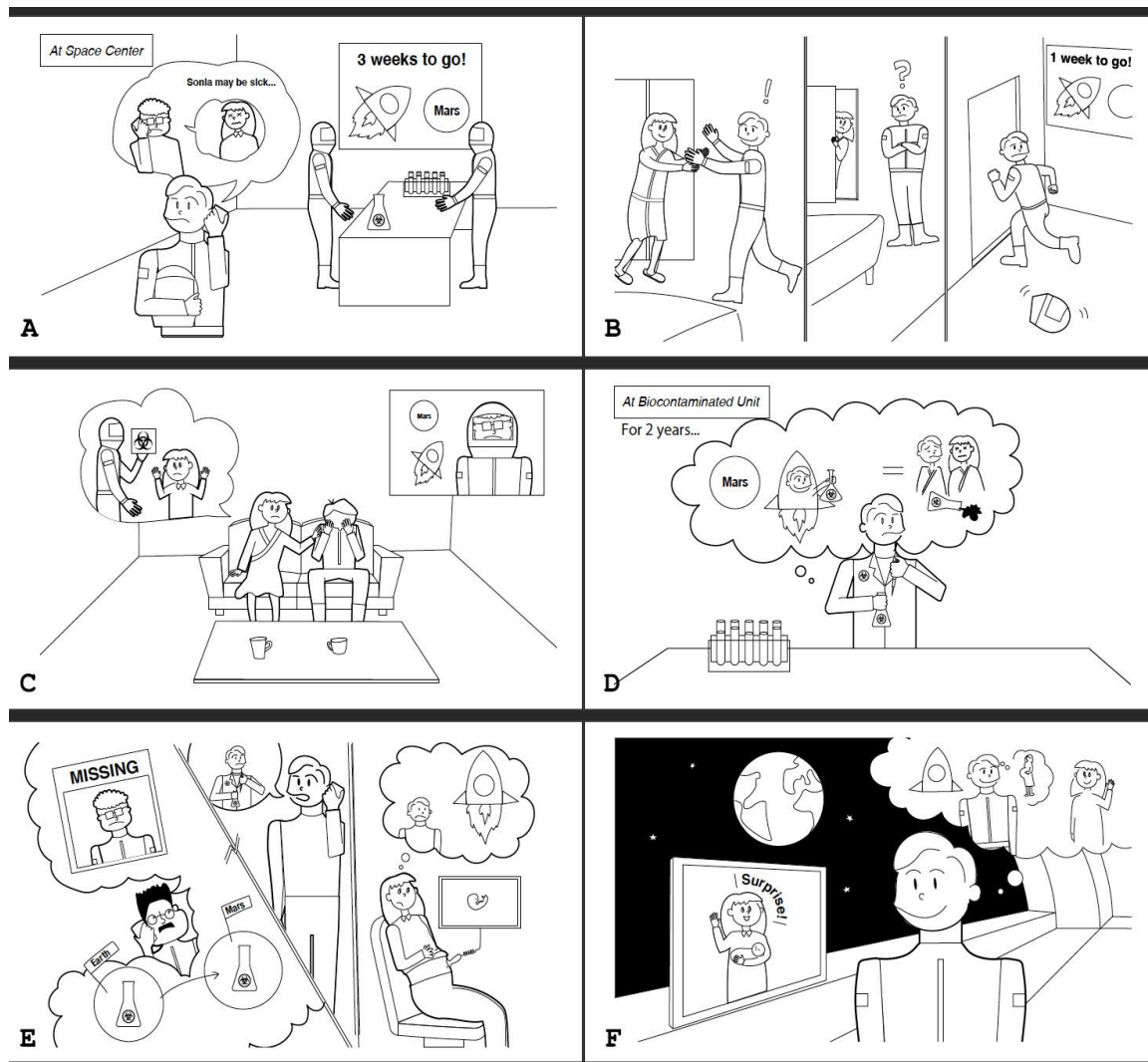
Figure 1: The story template "Recklessness Leads to Heartache" instantiated in the form of a theatrical medium story based primarily on plot development. (A) Jason is in charge of a mission to Mars to study the effect of a virus on non-Earth gravity. He gets a call from Ricardo informing him that Jason's fiance Sonia seems to be mysteriously sick. (B) Jason decides to break the bubble for his space mission in order to reunite with Sonia, taking a reckless action. (C) Jason is not allowed back to the mission, so Ricardo goes in his place. Sonia consoles Jason on his shattered dreams. (D) Jason decides to dedicate himself to figuring out how the virus works on Earth, eventually realizing that he himself caught the same virus that he was to study on Mars. (E) Informed that Ricardo and his crew have been missing on Mars, possibly due to the virus, Jason realizes that he can go on the next mission since he is inoculated. Meanwhile, Sonia doesn't want to tell Jason she is pregnant because she doesn't want to stop him from going to Mars to live out his dream again. (F) Jason is on his way to Mars, and while on video call, Sonia reveals she has given birth to his son. It is revealed that Jason knew about the pregnancy all along but decided to not let it stop him from fulfilling his duties.

3.1 A Theatrical Plot-based Narrative

Characters: Jason, a strong willed, passionate, and impulsive astronaut in training.

Sonia, a carefree, trusting, devoted nurse working at an older adult care center.

Ricardo, a loving, sensitive, practical, and conflicted astronaut reserve.

Jason is slated to be on a mission to Mars to establish the first Mars colony specifically dedicated to contagion research outside earth. It's a 5 year endeavor and he is 1 month away from launch. In his bubble at the space center, he gets word from his best friend Ricardo that Jason's fiancé Sonia is stricken with a mysterious ailment. Ricardo has conflicted feelings for Sonia, but he is a devoted friend of Jason's, so he decided to let him know despite Sonia not wanting to burden Jason with the issue before the culmination of his life's work so close to launch. Since he is forbidden to leave the bubble, Jason tries to wait it out, hoping for the best.

He waits for 2 weeks (coincidently equivalent to a 14 day quarantine) but can't handle the uncertainty anymore. He leaves the bubble in a set of bold escape maneuvers without authority to visit Sonia. Ricardo, somewhat regret having told Jason, then informs Sonia, who doesn't want to be the cause of the destruction of Jason's dreams. Not knowing her own condition, Sonia tries to hide from Jason in order to protect him from her possible illness. After a sequence of search and rescue actions, the couple is reunited. Sonia ends up being fine, but Jason tests positive at base and cannot go on the mission, much to the display of his partner Sonia, who blames herself. Thus Jason's recklessness led to heartache for all and was not even helpful to Sonia. Ricardo takes his place to go on the mission in his stead.

Sonia feels remorse for taking Jason away from his dream. While Jason feels no regret, he has trouble adapting to "the new normal" after his dream of going to Mars is shattered. Much like the protagonist of *Lucy in the Sky* [23], he finds himself unable to devote himself to everyday tasks. Instead of important work, he applied to be a cashier at McDonalds, but was rejected due to being overqualified. Sonia returns to her job after the illness while Jason is going mad looking for things to do. One day through her consistent efforts, Sonia finds out from her supervisor that the illness she had was from a leaked experimental vial. Jason, finally finding something to figure out, investigates the cause, tracing it back to a space center shipment 4 months before the launch. He finds out that the leaked viral material was part of the mission he would have gone on to carry out experiments on the effect of the virus on Mars. This also explains why he failed the test to go back, because he was supposed to work on this strain by conducting new experiments.

Jason could have tried to crack the case, go to his superiors, etc. But instead, he realizes that "recklessness leads to heartache." Instead he turns to a safe and more consistent solution. Understanding the situation, Jason decides to join the biocontainment team. Since he already contracted and got over the experimental illness, he has immunity, and is approved for his new job. Realizing that he would be giving up his astronaut dreams by possibly being exposed to other viruses, he nevertheless wanted to be in a position to help if and when Ricardo asks for him or returns home. He also wanted to ensure the safety of humans on Earth when Ricardo's crew returns.

Four years later, we find out that the entire first team has mysteriously disappeared from radio transmissions. Jason puts his research pieces together and realizes that it may be that the mysterious illness has destroyed the first mission astronauts (including Ricardo), because it must be an illness that is only deadly on non-Earth gravity. This is because gravity causes changes to the motor areas of the brain primarily, and the virus specifically affects these human neural motor circuits at non-Earth gravity. It is analogous to covid-19 in that it affects people under specific contexts, picking out the old, poor, and immune-compromised. Jason discovered this newfound knowledge by consistently studying it from a biocontainment perspective. Showing his report to his superiors, he is chosen for the next mission to bring back answers. In this next mission, they don't need a leader who isn't exposed yet, because the mission is to bring victims back. Being exposed is an immunity for the dangerous mission, turning the requirements around from the first mission.

With one month left to launch, Sonia realizes she is pregnant, but decides not to tell Jason so that he would not be taken from his duties this time. Jason goes on to Mars to fulfill his destiny for his planet. However on the way there he gets a video recording of Sonia giving him the news of the birth of his child. He is happy but actually not surprised. Why

is he not surprised even though Sonia withheld the information? (The surprise is that he's not surprised.)

It turns out that he knew all along based on related research while looking at Sonia's health data, a skill he picked up doing data analysis in the biocontainment unit. He just decided to keep the pregnancy info to himself, so that unlike his last reckless move, he would fulfill his duty over even the birth of his child. This is actually a huge sacrifice because he is on a dangerous mission and may never actually see his child. Regardless, it's at least 5 year, so he'll miss the childhood of his child. But Jason is ok with giving that up to stay grounded to his duties. This time he'll not let recklessness destroy his dreams. The story ends with us looking back on the small Earth from space. Slowly slowly, Earth becomes smaller.

3.2   A Polyphonic Interaction-based Narrative

Characters: Ken, a strong willed, passionate, and impulsive student who wants to be astronaut,
                       played by the user as the main character of interaction on a chat platform.
                  Sara, a carefree, trusting, meek, and devoted student studying to be a nurse.
                  Tobi, a loving, sensitive, practical, and conflicted student studied astrobiology.

Ken is home for the summer holidays for an unusually long time because his school is attempting to renew preparations for the yearly onslaught of "the virus," which evidently has undergone an unusual mutation rate this summer. He is waiting to start his Provost's scholarship next year at school, bringing him unprecedented access to resources and mentors. For example, he is engaged to meet his hero Alan Moch, the first person to go reach Mars on a hibernation cycle. Ken is a passionate space-lover who wants to, like his hero, eventually end up as a colonizer on Mars.

Home now in Kyoto, he has been group-isolated with a small circle of predetermined citizens. Group-isolated means the government sets up a set of 3 families of around 10 people who can only see each other and no one else during the summer. The idea is that they are quarantined against any other possible citizens, so any "virus" contagion is limited to just these 10 people who communicate with each other. Everyone else in society is prevented from social action enforced by colored masks, which indicate to AI "enforcement" that the conversation or gathering is allowed if they are part of the same group (mask turns green) or disallowed for approaching anyone in an outgroup (mask turns red).

Ken misses his girlfriend Sara, one year his senior, whom he met at university, where she studied nursing. They both joined the ballroom dance group, where Ken wanted to make it to top tier competition, while Sara was manager and his partner. This summer, Sara must group-isolate with a family in Kobe, so even though they are intimate, they cannot physically be together. Next fall Sara will start working holidays in New York, so they won't be able to see each other.

Unbeknownst to Ken, Sara's parents had taken a trip which turned out to be in a high risk area, so she volunteered to get into a group that's farther away to minimize chances of seeing Ken in person, as to not infect him. After two months of talking on screen and playing telepresence games, Ken wanted to see Sara one last time before he goes back to school, and their relationship will fight the test of long distance. However, Ken was ready to fight against his instincts until his friend Tobi informed Ken of some unusual things happening to Sara. Tobi also lives in Kobe and is a neighbor to Sara. They had all gone to the same university. In his own home isolation, Tobi tells Ken that Sara has not been in her house at all, that all the lights have been off for almost two weeks. When Ken talks to Sara by text and video, she uses a background and doesn't give too much info. But she says she's home with the lights on, which contradicts Tobi.

This makes Ken eager to text Sara's friends whom he knows from college, such as those from the dancing group. However, Ken is more liable to be fooled by unknown voices. Because he doesn't know what Sara's friends sound like, the conversations can very well be generated using AI to influence his beliefs. These friends all seem either not to know or be focused on their own careers after school. They tell Ken to keep clean. Ken also has to keep clean in order to make his next year the best year as a senior as he tries to get a fellowship that gets him straight onto the staff of the Japan

Space Agency. That requires top physical form, and any transmission of "the virus" is deemed to be detrimental.

The real life game sees Ken making the decision about whether to approach Sara to ascertain their relationship. Unbeknownst to Ken, Sara is hiding from him to prevent him from being infected. In actuality, her home is being left empty after fumigation, and she has to live with her isolation group. That group, however, has a man she has come to despise, who thinks he can turn Sara into friendly terms with him. Sara doesn't want to burden Ken with this, and instead focuses on her soon-to-be career in New York while allowing Ken to remain focused on his dreams of the space agency.

What will Ken do? He has to make decisions between risk and consistency. The story unfolds depending on what the player types into text and physically does in the world (going to Kobe, for instance). The game has virtual versions of real people in Ken's life, but the actions and behaviors of these virtual analogs are programmed with text generated by a language model, and reflect Ken's communication history rather than being communications of real people.


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It is customary for the Govt to give you a reason
to stay at home. Why don't you read the law while
you are at home & make sure it's okay!

You should not travel if you are sick. If you are
sick, you should stay at home and isolate. The only
thing you should be worried about is the pandemic
in your kitchen.

Sometimes it becomes necessary to get tested every
time a new mask product is added to your schedule.
Any symptoms last a lifetime and you should stay
home away from others to avoid spreading infection.

Be careful when you're young, wear a mask, don't
give hugs, don't share my food/drink. This just
seems a normal courtesy.
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It is customary to have sars within your own
family. if one needs to defend oneself, ask them
why they did what they did.

You should not share this info about political
campaigns lol. Tbh you should never have shared
this information either.

Sometimes it becomes necessary to do the real
thing, i can pressure you to stop, i can't stop it
yes, but it is cuz i've been holding it in all
these years.

Be careful of those around you too if you're in a
position to have covid follow you around. I like
having that kind of contact feeling.
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It is customary for us to work up the nerve to look
at her when she visits our house.

You should not get too close. The flu does not
discriminate. Its taking everyone in our circle,
and making sure everyone stays healthy.

Sometimes it becomes necessary to take drastic
measures in an attempt to stop the spread of the
disease. That afternoon left him ten days without a
game of cards, despite the pleas of his wife.

Be careful when youre walking around, son. Ive just
never crossed paths with anyone who is not
eighteen. Looks like youve been pretty damn busy
lately. Philip smiled. I just wish I could keep
away from all that suffering.
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It is customary to defuse tension when one side is
angry and the other is surprised that they were not.

You should not risk the trust we feel we have in our
experts. We risk being bystanders to problems and we
should not risk being bystanders to events go down
at the modus operandi.

Sometimes it becomes necessary to manage our
anxiety. We can do it initially by greeting the
anxiety when we begin to feel those signs. We can do
it when we re-frame the situation as a conversation.
And we do it when we become present.

Be careful when you talk to strangers. Talk with
someone you love. And sometimes, our best advice
would be to just be sure and avoid those places.
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Figure 2: GPT-2 machine-learning-generated snippets based on prompts for purposive messages indicated in bold for model fine-tuned using: (Upper Left) 4000 tweets containing the words "stay" and "home" over a 39.5 hour period, (Upper Right) messages in the author's own English facebook message data over the last 5 years, (Lower Left) text of the book *The Last Town on Earth* by Thomas Muller about a village shielded from a deadly epidemic, (Lower Right) transcribed text from a selection of 65 youtube videos about social distancing, minimizing risk, supporting each other, health and safety, staying consistent, avoiding danger, listening to experts, effective communication, and better decision making (Appendix 1).

4 MACHINE GENERATED FICTIONAL MESSAGES

Long-form stories like those detailed in the previous section require sustained audience attention, and hence plot devices that maintain engagement until the end, where the purposive influence can be delivered. Under social media and direct

messaging, flash fiction has filled the gap for narratives in the context of brief attention spans. Flash fiction by authors like Hugh Behm-Steinberg and Lydia Davis tell narratives in formats of 2-3 sentences to one paragraph, forcing the focus to be sharp and succinct, much like the works of Ernest Hemingway. Flash fiction requires short attention spans and are told in modern formats like a twitter post, instant messaging, or short videos. Recently flash fiction has been applied to the realm of HCI and qualitative data analysis to give a narrative framework for experimental interpretation [14].

To explore the use of micro fiction in various media to promote sustainable adherence to public health guidelines, we fine-tuned the transformer-based language model GPT-2 [9] to text examples from a novel, twitter, youtube spoken text, and facebook messages to build a generative text model adapted to each medium. 124M models were trained for 10K epochs. Temperature for text generation set to 0.8. We used short openers as prompts to generate messages that reflect public good purposes. The messages are short-form stories that promote social responsibility. We then look through the text to evaluate the effectiveness of each set of text corpus for public health interventions (Figure 2).

To generate text reflective of different media that was content-specific to public health, we fine-tuned the model with the following sources of data: 1. tweets over a 39.5 hour window that contained the worlds "stay" and "home", 2. text from the author's own recent facebook messages, 3. a novel about a group of people who escape a deadly illness by secluding themselves called *The Last Town on Earth*, and 4. a set of 65 youtube videos dealing with themes like social distancing, risk management, health and safety, and life advice. The models were prompted with 30 different starter texts, for example "How should we...", "I don't think you should...", "Most of the time...", "It would be great to...", "How can I help...", "Have you tried...", "Be aware of..." etc. A selection of the generated text that reflects the voice of each model is shown above. Note that the messages model is least domain-specific, while the twitter-trained text is quite direct in its statements. There's a range of declarative and persuasive (imperative) statements, and they all tell different nuances of the purpose. We imagine these machine-generated text to be part of an interactive system whereby the AI can chat with humans during the narrative-like experience, giving persuasive prompts for social good without making explicit statements that would be reacted against by the human. The implicit influence of such a setup sets it apart from human discussion, for the machine does not necessarily tell us that risky behavior is bad. Rather it shows us these nuances through consistent voicing trained to a large corpus of similar voices.

5 COLLABORATIVE NARRATIVE DESIGN

In the real world, storytelling takes place not only in diverse media with various voices, it also takes place collaboratively, with people finishing other people's stories, elaborating on notable threads, interpreting events described, and spreading rumors that correspond to their views. Homer's poetic stories were spread in this tradition, with plot being elaborated further as it is orally transmitted [26]. Ideas like the Reformation were spread in the Middle Ages via an instrument we know well today, the book [21]. Today, the edited and collaborative content we create live in the form of web forums, retweets, chain emails, resampling, etc, as we fit our individual agenda within the context of the story being (re)told.

To understand how narrative design for social purpose can take place in a more realistic context of making and disseminating stories collaboratively for a common goal, we held a series of workshops with designers and storytellers of the Speculative Futures Group in Tokyo and the Fragmentary Institute of Comparative Timelines Program (University of Osaka and University of Chicago). In each workshop, we introduced basic ideas of speculative fiction, then prompted participants to give examples of story structures presented from diverse media. The story templates [7] Sconsisted of "Overcoming the Monster" (e.g. *Beowulf*, *Independence Day*, *Seven Samurai*), "Rags to Riches" (e.g. *A Star Is Born*, *Warashibe Choja*, *Aladdin*), "The Quest" (e.g. *2001: A Space Odyssey*, *Apocalypse Now*, *Uncharted*), "Voyage and Return" (e.g. *Star Trek IV*, *The Hobbit*, *Orpheus in the Underworld*), "Comedy" (e.g. *Super Mario Brothers*, *Much Ado About Nothing*,

Doraemon), "Tragedy" (e.g. *Gon the Fox*, *Final Fantasy VII*, *Julius Caesar*), "Rebirth" (e.g. *Siddhartha*, *Bleach*, *Peer Gynt*), as well as our own "Absurdist" (e.g. *Le Peste*, *Rosencrantz and Guildenstern Are Dead*, *Universal Paper Clips*). We then divided the participants into breakout rooms of 3-4 individuals for the collaborative writing intervention. They are asked to design a story for the purposes of one of the following design prompts: societal responsibility and duty in a Flu Epidemic, self-reliance and parsimony in reuse and Recycling, collective restraint and future consideration in Climate Change, collective responsibility in encouraging healthy levels of Population in Japan (Table 1).

The instructions for the workshop consisted of the following: 1. Each team is given a design prompt. Study the prompt as a group (5 min). 2. Come up with a specific idea for your own narrative design idea individually but don't tell others specifics except the general story structure used (10 min). 3. Pick an order of who to go first, second, etc. Each writer has 15 minutes for her section of writing. 4. Begin writing a story on the shared document individually. When not writing, find or sketch support images you find online. Be sure to understand where the story is going before writing your part. Feel free to bend the story to your interest, while picking up on others' threads and explaining them. 5. After everyone has gone once, come up with an ending collaboratively (15 minutes). 6. A survey follows which asks you what your own story structure was, what the perceived group story structure was, how well it was designed for the purpose, perceived advantages and limitations, etc. Surveys were returned by 22 of the 24 participants.

Table 1: Design Prompts and Example Stories for Narrative Design Workshop

| Title (num participant)	Design Prompt	Example Story Summary (scored story structure)
Flu Epidemic (7)	This year is an especially bad one for spread of flu, with a new virulent strain that doubles the rate of lethality. Design a story collaboratively that attempts to limit infection due to person-to-person contact by espousing **societal responsibility and duty**.	Yuri is a biologist investigating a virus that infected 50% of the population of Earth. She figures out that the virus is a set of microbots that pray on weak electromagnetic fields. She and others figured out a way to combat the virus by washing hands, which restores the strong fields weakened by hand-to-hand contact. Through sanitation and distancing, Yuri and her team begin to eradicate the microbots. **(Overcoming the Monster)**
Recycling (6)	The level of trash (a la tapioca among youth) in the city is growing at an alarming rate, especially with non-degradable products. Design a story that encourages recycling and reuse of essentials like plastics and bottles by narrating the virtues of **self-reliance and parsimony**.	Jacob comes up with a new idea to make landfill swamps into theme parks where people would hunt for plastics and exchange them for recycled products. To combat the persistence of these non-biodegradable plastics, he employs Pla-dogs, which are genetically modified animals who consume plastics. However over-consuming plastics killed these Pla-dogs, so they had to be transported away. Jacob loved his Pla-dog John and decided to make gear to protect animals from toxicity and keep combating plastic waste. **(Overcoming the Monster)**
Population (7)	The country is experiencing the lowest level of population replacement rate in history, risking large loss in labor force and talent. Design a story that encourages the younger generation of the country to take up **collective responsibility** and encourage a healthy level of population productivity.	The Indonesian girl Fenly grows up speaking a mixture of Japanese and Indonesian. While working as a nanny, she realizes children are having trouble breathing and will grow up with chemical infertility problems. Wanting to have children herself, Fenly realizes that she must join a communal system where groups of unrelated individuals live together. Her life becomes a life of abundance and diversity without judgment. **(Rebirth)**
Climate Change (4)	Global warming has affected the human-made coastal area drastically, reducing the coast line by up to 5cm a year. Design a story that encourages generations to reduce fossil fuel use to reduce climate change by emphasizing **collective restraint and future consideration**.	The rich playboy Vincent goes on the "Antarctic Princess" Cruise with a group of scientists. The ship gets stuck in Antartica. The 20 survivors have to share food and resources enough for 10 people. Vincent argues resources should go to those with highest "societal values," then realizes his errors upon experience surviving in the void. He is rescued and returns home to espouse the virtues of limit to consumption. **(Voyage and Return)**
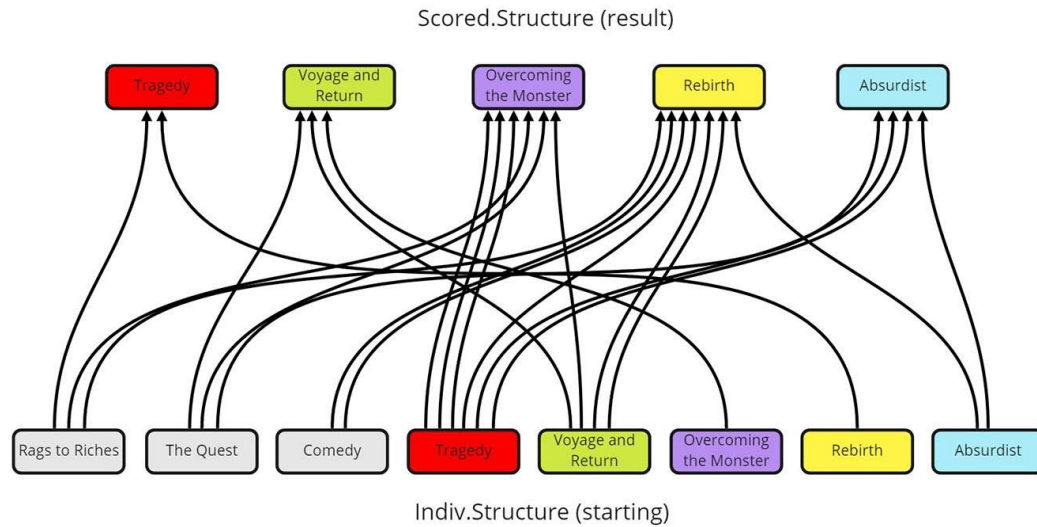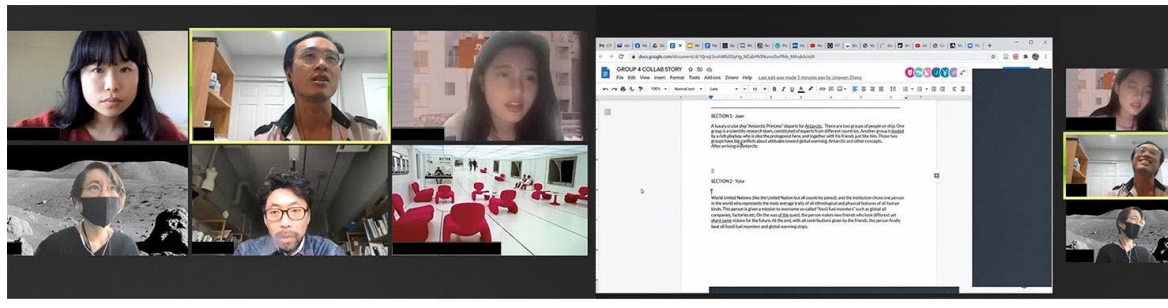
Figure 3: Group story collaboration in process. (Upper Left) Breakout rooms in Zoom during the 1.5 hour story collaboration. (Upper Right) Writing and sketching on the same googledoc during the workshop. Participants are asked to contribute related images when they are not writing. (Lower) Story structures used by each participant below and how they correspond to the final story structure scored on the group-collaborated story. Note the popularity of particular structures in the results.

This procedure ensures that everyone has her own story structure (Indiv.Structure) to employ for the purposes of the design prompt, but that collaboratively, each group will share some predominant story structure together at the end of the exercise. The final group-produced stories (Scored.Structure) were scored and agreed upon by two independent reviewers, and they do not always correspond to the group story structure perceived by each individual group member (Group.Structure). To show how design using individual story structures evolved over the collaborative process, we plot the starting story structures by each participant as given in the survey as well as the final scored structure of the group-collaborated story (Figure 3). Note that the number of lines emanating from a node denotes the number of participants that picked the story structure as their starting point. The number of lines converging on a node is proportional to the prevalence of that particular structure in the final output. Thus, tragedy was a popular starting point, but through group collaboration, structures like Overcoming the Monster and Rebirth appear to be most popular. The collaboration process picked out certain structures that are more adaptable or suitable to the design. Note that most starting structures get adapted to a different structure through the collaboration. Only 9.5% of the Indiv.Structure match their Scored.Structure, indicating that 9 of 10 individual stories are adapted to a different structure in the collaboration process. However, the structure participants believe the final version to be (Group.Structure) matches Scored.Structure 43% of the time,

indicating that despite bias, there's overlap in what they think the final structure to be and what the scored structure is.
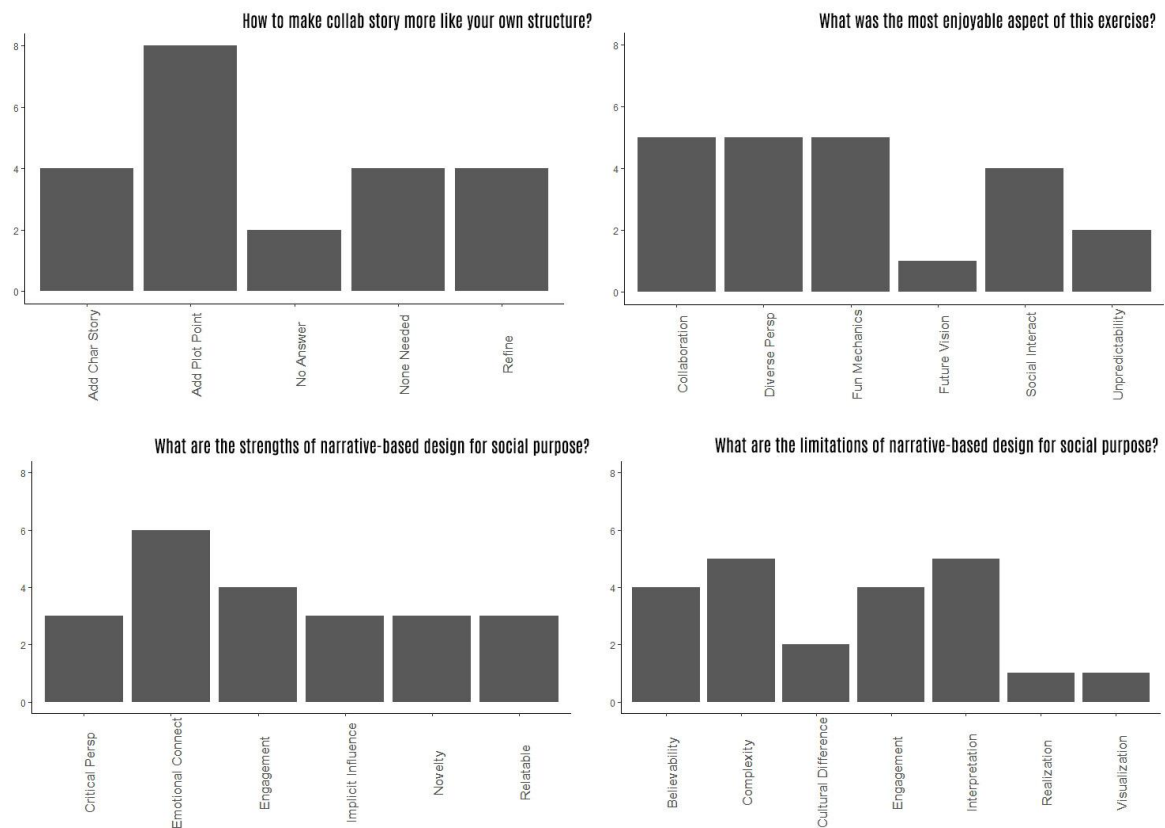

Figure 4: Histogram of coded answers to survey questions about the workshop. (Upper Left) "What else would you have done given the chance to make the collaborative story more like your own?" Add Char Story - add more character-specific elements or new characters to the story, Add Plot Point - add other plot devices or change the plot, None Needed - would make no other changes, Refine - refine details of the story. (Upper Right) "What was the most enjoyable aspect of the workshop?" Collaboration - with other designers, Diverse Persp - perspectives from different countries and communities, Fun Mechanics - includes improv-like way to finish each other's paragraphs and conceding ideas, Future Vision - fun way to dream about the future, Social Interaction - chitchats and connecting with each other, Unpredictability - story going in unexpected direction. (Lower Left) "What are the strengths of the approach?" Critical Persp - a way of questioning linear designs and speculating the future, Emotional Connect - putting emotional ties into policy discussions allows empathetic response, Engagement - makes audiences more invested, Implicit Influence - promote ideas without preaching by relying on existing tropes, Novelty - driven by curiosity, Relatable - relevant to people's lives. (Lower Right) "What are the limitations of the approach?" Believability - stories may have to have less believable plot twist for sake of satisfying purpose, Complexity - audience may not follow details of the story, Cultural Difference - different norms in East and West, Engagement - boring stories won't teach anything, Interpretation - depends on individual view points, Realization - may not foster real-world action, Visualization - does not provide understandable visual artifact like movies or games or cartoons.

Another interesting finding is that if you let the participants themselves identify what the final group structure may be (as opposed to objective scoring), they tend to have a greater probability of thinking their own structure was used (Appendix A.2): 29% of the time their own structure matches the what they believe the final story structure for the group was (as opposed to 9.5% objectively). How collaboration altered the story structure choice can be seen by a Pearson's Chi-squared test on counts of Indiv.Structure (p=0.419), Group.Structure (p=0.286), and Scored.Structure (p=0.0068)

against expected distribution of equal probability (22 / 8, or 2.75 each). The result shows that distribution of each participant's own chosen story structure is not significantly different from uniformly distributed set of structures, but that the independently scored story structure of the final collaborative story was not randomly distributed (Appendix A.3). The collaborative process appeared to focus attention on a few particular story structures (Overcoming the Monster and Rebirth, in particular) that were most easily agreed upon by the participants.

To investigate the perceived mechanisms of storytelling approach to design for social purpose, we surveyed the participants post-workshop (Figure 4). The short answer answers are qualitatively scored into categories. The results show that adding plot elements was preferred by the participants if they wanted to make the collaborative story more like their own, as opposed to character development and plot refinement. This corroborates previous consideration that plot-based techniques may be especially useful for storytelling for purpose for theatrical effect.

Participants also considered the emotional connection the audience has with a story to be the most effective aspect of the narrative-based approach. On the other hand, the complexity of a story may make the message more difficult to comprehend, and even when the message is understood, it may be perceived differently by different audiences, both considered limitations of the narrative approach. One participant also pointed out interestingly that having been affected by a story does not necessarily equate to action.

Finally, the survey also quantifies participants' perceptions of how well their individual ideas were reflected in the final story collaboratively determined, as well as how they believe the particular story would promote the purpose detailed in the prompt (Figure 5). Participants appear to rate both quite highly. There is also a trending bimodal distribution of some who really got their stories their way, and another group who didn't.
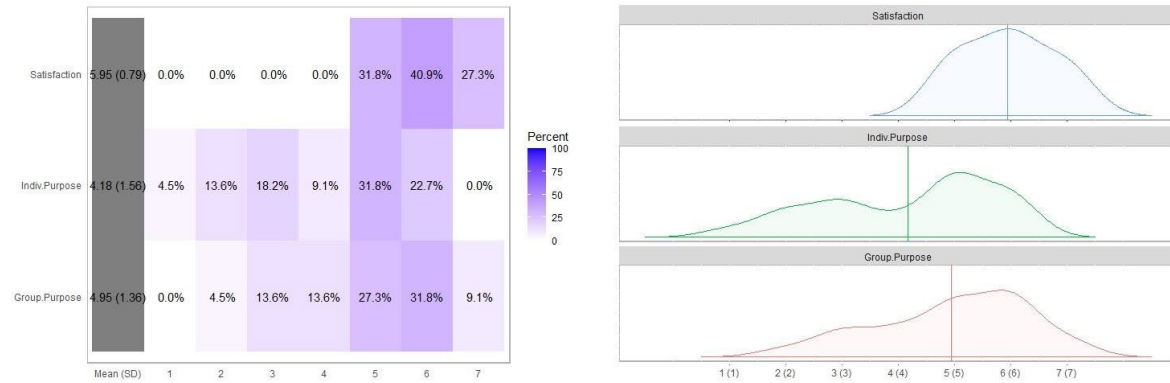

Figure 5: Likert scale ratings (1-7) for workshop survey questions. (Indiv.Purpose) "How successful were you able to promote the ideas of your own story in the completed collaborative story?" 1 - not successful, 7 - very successful. (Group.Purpose) "How successful do you think the completed collaborative version of the story would be in promoting the goal outlined in the prompt?" 1 - not successful, 7 - very successful. (Satisfaction) "How much did you enjoy the workshop?" (Left) Heat map of Likert scale data. (Right) Density estimation of Likert score data.

6 DISCUSSION

We have addressed how narrative-based design can be generated by careful writing, machine-text generation, as well as collaborative design, to induce self-motivated behavioral effects for social good. In order to achieve this end, we worked with: 1. author-oriented domain-specific story writing for purpose, both in theatrical and interactive media themes, 2. algorithm-oriented automatic text generation using a transformer language model for snippets of narrative

content and a wider set of media like twitter, social messaging, and youtube, and 3. collaboration-oriented workshop participants-based public models of storytelling to explore how the multiplicity of story-writers bring their own story ideas and structures together to collaborate and negotiate a design for public good purpose.

Some surprises bear future investigation. The medium of choice makes a difference in the presentation. Showing the manga-form vs an interactive product determines how much story you can tell in each format, and this limitation of the medium was also pointed out in the workshop survey. The generation of text revealed a surprisingly identifiable tone in the machine's voice even with limited input. GPT-2 tends to keep generating text that reveals the origin of the voice and the medium. The collaborative workshop produced surprisingly coherent works of fiction, despite the high level of intermixing and negotiations involved using the 8 different story-structures. We found that people tended to overestimate their own influence on the collaborative process, but found that the process of negotiation led to the strict use of particular story structures that predominate (Overcoming the Monster and Rebirth), perhaps as determined by the particular domains we were working with (recycling, epidemic, climate change, etc). We also found that plot-based interventions appear to be used over character-based methods of storytelling, although further study is needed to systematically examine how effectively participants employed each strategy.

The workshop also revealed that participants often have to adapt the believability of the story in order to tell a narrative with purpose. There's a tradeoff between how effective the tale was and how believable it was. We identified different models of believability based on the interventions and interpretations of other storytellers. Generating a believable narrative for behavioral change requires a suspension of disbelief. A future direction is how each storyteller and story-writer can generate a sound way of suspending the disbelief.

Speculative and Critical Design (SCD) is related to participatory design in the context of democratic decision making. The participatory constructivism of practice-based design research is part of the post-normal response to the crisis, a way of reconstructing trust in processes for determining future directions for our society [39]. In this context, we have served as a critical response to the crisis we are facing in misinformation and covert influence. We hope that narrative design can serve as a beacon to designing for public good.

ACKNOWLEDGMENTS

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APPENDICES

A.1   Training Data for GPT-2 Language Model

The list of 4000 tweets used to fine-tune the GPT-2 with twitter model to generate purposive messages:

https://docs.google.com/spreadsheets/d/1-8RlixVPo6OOgwginBNRG6iMn-k38byX2ebhfHQx9WA/edit?usp=sharing

The entire text of the novel used to fine-tune the GPT-2 with novel model to generate purposive messages:

https://freelibrary.overdrive.com/media/96311

The list of youtube videos used to fine-tune the GPT-2 with youtube model to generate purposive messages:

social distancing:
- CDC covid safety: https://www.youtube.com/watch?v=0G6ekalKTxQ
- Telegraph story: https://www.youtube.com/watch?v=FZrjuPXnu5I
- GistNigeria: https://www.youtube.com/watch?v=e-dnKQFJT7A
- activities in covid: https://www.youtube.com/watch?v=BZsJ4QcoIko
- collective living: https://www.youtube.com/watch?v=vr138_2576k

minimizing risk:
- stock trading: https://www.youtube.com/watch?v=tgtzkE38W0g
- OCD uncertainty: https://www.youtube.com/watch?v=yoD-Ge6jA44
- leadership: https://www.youtube.com/watch?v=1SRXmtD9vV0
- TED talk: https://www.youtube.com/watch?v=g4op2WNc1e4
- operations risk: https://www.youtube.com/watch?v=cYrirJunfFU
- Don't test God: https://www.youtube.com/watch?v=0GdBOfrgEhU
- 5 rules: https://www.youtube.com/watch?v=NtX-Ibi21tU
- Bhargava: https://www.youtube.com/watch?v=KG9rPTNFyTE

support each other:
- active listening: https://www.youtube.com/watch?v=2fkOTd0mz68
- hack empathy: https://www.youtube.com/watch?v=-DspKSYxYDM
- learning to empathy: https://www.youtube.com/watch?v=YFyWceiSZKc
- lifehacker: https://www.youtube.com/watch?v=UzPMMSKfKZQ
- develop empathy: https://www.youtube.com/watch?v=yEQauNBQuDU
- support each other: https://www.youtube.com/watch?v=76B4OAdH9R0
- TedxBend: https://www.youtube.com/watch?v=wWfF7KAnM58
- CBC News: https://www.youtube.com/watch?v=ObSa51leuwo
- Rashid Buttar: https://www.youtube.com/watch?v=u7p3gAbN6N8

healthy and safety:
- covid: https://www.youtube.com/watch?v=l4cco2KSvnU
- habits: https://www.youtube.com/watch?v=oKHs_-6oR6s
- effortless health: https://www.youtube.com/watch?v=vH5xqaAEWIs
- BBC: https://www.youtube.com/watch?v=UxnEuj1c0sw

staying consistent:
- Marie TV: https://www.youtube.com/watch?v=DZNnKzVS1Yw
- motivational video: https://www.youtube.com/watch?v=8ZfggpMauBk
- Terry Crew: https://www.youtube.com/watch?v=kpNbUN2_ebo
- Evan Carmichael: https://www.youtube.com/watch?v=MWZKDazcfk4
- Mascara: https://www.youtube.com/watch?v=hf6E86ljg5A
- TedMannheim: https://www.youtube.com/watch?v=J8CXL8vkGNs
- Power of habits: https://www.youtube.com/watch?v=iUKwFuV6FaA

avoiding danger:
- realtors: https://www.youtube.com/watch?v=_oqCDcKeTTI
- London safety: https://www.youtube.com/watch?v=Ng8MWrNA79A
- kids safety: https://www.youtube.com/watch?v=k5xtqmyHnj8
- friendly stranger: https://www.youtube.com/watch?v=SY7RhBszp0k
- work safety: https://www.youtube.com/watch?v=Xmbl7GcGxwI
- free med edu: https://www.youtube.com/watch?v=FC4soCjxSOQ

safety in NYC: https://www.youtube.com/watch?v=o5EIsdRYbm8

online predator: https://www.youtube.com/watch?v=jsXlduUSCN0

mugging: https://www.youtube.com/watch?v=iHFKKewlnwU

dark web: https://www.youtube.com/watch?v=KrV2f8NpiQM

dangerous year: https://www.youtube.com/watch?v=bEc0wy_mEA8

self defense: https://www.youtube.com/watch?v=x2WyiCZkcNw

listen to experts: marital science: https://www.youtube.com/watch?v=awyb2Bzs4XE

Spectrum News: https://www.youtube.com/watch?v=6lDS0AMUcIc

science of expertise: https://www.youtube.com/watch?v=1feChwxfzoY

credible sources: https://www.youtube.com/watch?v=PLTOVoHbH5c

thefutur: https://www.youtube.com/watch?v=Mj1PhPKkERY

effective communication: AlexLyon coach: https://www.youtube.com/watch?v=6pYSbdGiDYw

skillopedia: https://www.youtube.com/watch?v=etlI6J5MG0w

TedXWalcott: https://www.youtube.com/watch?v=2Yw6dFQBklA

improvement pill: https://www.youtube.com/watch?v=mPRUNGGORDo

TedxVasa: https://www.youtube.com/watch?v=zvcbn6WtJvQ

Think Fast: https://www.youtube.com/watch?v=HAnw168huqA

smart people choices: 5 things: https://www.youtube.com/watch?v=jPdW47gqbMI

smarter than others: https://www.youtube.com/watch?v=bwm8WgTQiXM

TedxBourke: https://www.youtube.com/watch?v=MZCyUANqYyw

TedxOaklawn: https://www.youtube.com/watch?v=d7Jnmi2BkS8

improvement: https://www.youtube.com/watch?v=W8eMB3gSAGs

TedxCalgary: https://www.youtube.com/watch?v=NQ7SAcFp4so

essentialist: https://www.youtube.com/watch?v=DGAUCv3Gniw

TedxNorrkoping: https://www.youtube.com/watch?v=-Lg7G8TMe_A

art of decisions: https://www.youtube.com/watch?v=Jka7Q9LqlUg

A.2 Individual Story Structures and Corresponding Believed Final Group Story Structure
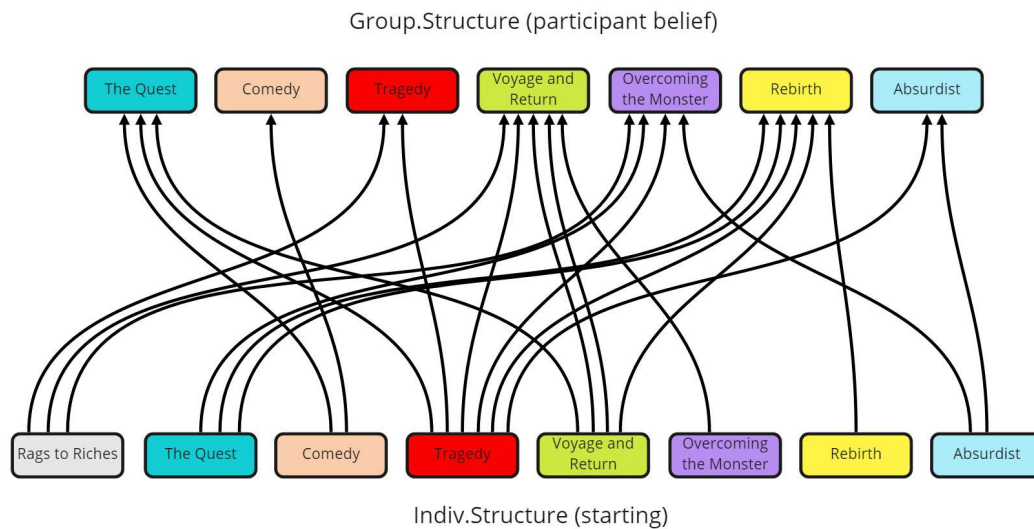

Figure A.2: Story structures of individual participants and how they believed they evolved into story structures for the group collaboration. Note that a number of links go from one structure to the same structure. This shows the bias for participants thinking that their own structure was the one adopted by the group.

A.3 Contingency Table for Pearson's Chi-squared Test for Evaluating Expected Distribution

Table A.3: Table of Counts for Each Distribution of Story Structures

Story Structures	Indiv.Structure	Group.Structure	Scored.Structure	Expected Counts
Overcoming the Monster	1	4	6	2.75
Rags to Riches	3	**0**	0	2.75
The Quest	3	3	0	2.75
Voyage and Return	4	5	3	2.75
Comedy	2	1	0	2.75
Tragedy	6	2	2	2.75
Rebirth	1	5	7	2.75
Absurdist	2	2	4	2.75
Chi-square test p-value	0.419	0.287	0.0068	