Solutions Stories: An Innovative Strategy for Managing Negative Physical and Mental Health Impacts from Extreme Weather Events.

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Abstract Health impacts from extreme weather events have massive, deleterious effects on our communities. Plots from mankind's long history of storytelling cannot help us prepare for the unprecedented environmental shifts we are experiencing. Dystopian plots focusing on a catastrophic future caused by climate change often immobilize rather than spur action. Despite over a half-century of evidence that science and health communication strategies, including entertainment-education, can effectively change human behavior, such strategies are rarely applied by our contemporary entertainment or media industries. Tools from social psychology, including social modeling and building self and collective efficacy, can help us to create a new model for current, culturally-relevant stories that can help communities prepare for extreme events. These "solution stories" are hopeful, funny stories that effectively teach climate change adaptation, mitigation, and resilience strategies. Solution stories are set in the present day and frame climate solutions to feel "easy, fun and popular." Up-to-date research on adaptation, mitigation, and resilience strategies can be iteratively utilized in these stories to better equip communities to manage climate change disasters and lessen harmful physical and mental health impacts. An example of a potential climate communication solution story, "Rhythm and Glue," is provided. In summary, solution stories are an innovative management strategy for substantially improving preparedness and, hence, health outcomes among communities facing extreme weather events caused by climate change.

Keywords Entertainment-education. Comedy. Science communication. Social physiology. Climate mitigation and adaptation. Efficacy. Social modeling. Solutions stories. Climate fiction

Introduction

Climate change is causing extreme weather which is damaging to human health. Rising temperatures, flooding, drought, and wildfires can lead to physical consequences such as higher rates of heat-related illnesses (e.g., heat stroke), communicable diseases (e.g., West Nile virus), and respiratory symptoms related to poor air quality (e.g., asthma). Extreme weather threatens physical well-being as well as psychological health and resiliency. At higher temperatures, for instance, individuals are more likely to behave aggressively towards others and towards themselves (e.g., suicidal thoughts). Extreme weather also leads to greater risks that individuals will experience psychiatric disorders such as depression, anxiety, and substance abuse.

While there have been a few regional entertainment-education programs that have addressed sustainability concerns (Reinermann et al. 2014), given the scope and magnitude of climate change a larger, more systematic approach to applying established health communication practices to climate change is needed. In 2015, Emily Coren and Bill Ryerson, President of Population Media Center, began discussing options to create such a program. The show, Rhythm and Glue is the current version of that work, and this paper shares what we have learned through this process to assist other projects in scaling this work efficiently while continuing to facilitate the requisite media productions. Debra joined our team supporting entertainment-education and climate work by organizing a summit at Stanford in 2018 on Scripted Entertainment's Ability to Move the Needle on Climate Change.

The goal of this chapter is to provide a useful tool-set for constructing efficient, compelling disaster preparedness communication to decrease harmful climate change-related health impacts. After first identifying some of the major impacts of climate change on physical and mental health and reviewing effective actions that individuals and communities can take, we will discuss the potential for storytelling to serve as an effective climate communication strategy to improve disaster preparedness. The importance of framing these narratives as "solution stories" will be explained along with the more general principles of entertainment education, including the use of research and transmedia platforms. We include a specific example of a potential climate communication solution story, "Rhythm and Glue," to effectively teach climate change adaptation, mitigation, and resilience strategies. In the interest of preventative public health promotion, we include climate mitigation within our disaster management strategies. Our rationale is that the degree of future climate change will be largely determined by choices our current society makes about emissions (Jackson et al. 2015; Melillo et al. 2014). Stronger mitigation efforts can reduce the rate of climate change.

Health and Climate

Climate change has immediate negative consequences on human health (Luber and Lemery 2015; Lemery and Auerbach 2017; USGCRP 2016). Health impacts include: illness resulting from extreme temperatures such as heat stroke, respiratory diseases from poor air quality and wildfires, extreme events such as flooding and drought can cause water related infections (*Vibrio spp*) and food-related infections (*Norovirus*, *Salmonella spp*), increasing vector-borne infections (Lyme disease, West Nile virus), and mental health impacts. "While often assessed individually, exposure to multiple climate change threats can occur simultaneously, resulting in compounding or cascading health impacts." (USGCRP 2016). Promoting public health and designing our communities with healthy environments and resilient infrastructure will prepare us for our changing climate (Luber and Lemery 2015). "Nearly all avenues of public health promotion can act to reduce the risk of future climate-related disasters," (Keim 2015) (Figure 1).

Mental Health Impacts from Extreme Weather

The impacts of climate change on mental health are important to recognize. Though less well-known than the impacts on physical health, overlooking these mental health impacts can lead to a serious underestimation of both the short and longer term ill-effects of extreme weather (Clayton et al. 2017). Comprehensive reviews regarding the consequences of climate change on mental health (Hayes and Poland 2018; USGCRP 2016) make clear, for example, the associations that have been found between high temperatures and greater risks for violent behavior, aggression, and suicide. Additionally, extreme weather events such as hurricanes, wildfires, and drought have been shown to increase the likelihood of depression, anxiety, post-traumatic stress disorder (PTSD), substance abuse, and suicidal thoughts. Mental health effects include the loss of a sense of identity and place along with feelings of helplessness. Extreme weather also strains relationships, with increased rates of domestic violence reported. Potential outcomes include reduced cognitive functioning and depression resulting from infection with vector-borne diseases such as Lyme disease and West Nile Virus. Compounding these direct impacts of climate change are the related economic (e.g., job loss, displacement, homelessness) and social costs (e.g., isolation, reduced opportunities for exercise and other stress-relieving activities) that can adversely influence mental health. Further, while the mental health implications of climate change can affect everyone, these impacts tend to be greatest among individuals who are the most vulnerable and marginalized, such as those with pre-existing mental health problems, children, seniors, women (especially if pregnant), and/or the socioeconomically disadvantaged (Hayes and Poland 2018; USGCRP 2016).

An often overlooked impact of climate change on psychological well-being involves the chronic stress that results from ongoing exposure to headlines and media images regarding the catastrophic threats posed by extreme weather. Such chronic awareness is associated with generalized anxiety, a heightened perception of risk, sadness, guilt, pessimism, helplessness, and the loss of belief in either or both individual and collective efficacy (USGCRP 2016). Importantly, as this chapter will discuss in detail, how climate change information is presented affects how individuals respond. Coverage that is discouraging or scientifically inaccurate evokes a very different response than coverage that focuses on adaptive and preventive actions that can be undertaken individually or as a group (USGCRP 2016). Effective climate communication can serve to channel awareness into a trigger to actively engage in climate change adaptation and mitigation actions.

A number of positive mental health consequences have been shown to result from active engagement. Just as our changing climate has the potential to increase negative outcomes such as depression and aggression, it also has the potential to lead individuals to work with one another and exhibit empathy, compassion, altruism, emotional resilience (i.e., the ability to adapt and recover despite adversity), and post-traumatic growth (i.e., meeting trauma with personal growth, hope, the feeling of belonging, gratitude, and transformation). While active engagement in climate change actions does not necessarily decrease stress, it can offer a valuable buffer for managing stress and building emotional resilience — hence lowering the likelihood of experiencing negative mental health impacts.

Mental Health Resources to Promote Resiliency and Limit Negative Impacts of Extreme Weather

There are different types of resources to which individuals can turn to help promote their resilience and limit the negative consequences of extreme weather on their mental health. Examples of formal resources include obtaining referrals for psychotherapy/counseling, psychiatric medications, and/or inpatient psychiatric hospitalization. Given the positive psychological effects of active engagement in climate change actions, additional helpful resources include those that offer the opportunity to connect with others in civic action. One such resource is the Transition Town movement, a grass root movement in which citizens join together to help themselves and their communities respond to the changing climate (Transition Town Movement 2018). Such movements offer psychosocial support and help build individual and community-based resilience to help individuals and communities process their fear, despair and other responses to climate change (Christensen 2019; Higgins 2012; Macy and Johnstone 2012; Work that Reconnects Network 2018). A switch from images of pollution, environmental damage and protests to images to including social care check-ins and active emotional and physical community improvements (home repair, habitat restoration, civic participation) will provide constructive social modeling. The skills to model in solutions stories include active engagement in climate change adaptation and mitigation actions, as these not only directly address the threats caused by climate change but also have been linked to positive mental health benefits.

Solutions Stories

What is needed today are climate change stories that model successful conclusions through our own actions. These are solutions stories that give us agency, courage, and hope. Too many climate change stories emphasize inevitability, disaster, and loss (Schneider-Mayerson 2018). Such stories are about the problems created by the impact of climate change, so called ‘impact stories’. In contrast, ‘Solutions Stories’ offer a much-needed alternative. The stories are set in the present time and place and model resourceful people collaborating to solve sustainability issues. The narratives focus on how to succeed at desired tasks such as civic engagement, renewable energy, and habitat restoration. These are hopeful stories for to transitioning our culture toward collaboration, social resilience, and sustainable habits.

Solutions stories feature characters who possess a strong sense of personal and collective efficacy. Efficacy is our ability to succeed at difficult tasks. The daily realities of climate solutions are full of impediments and conflicts. The solutions are not easy. Social psychology teaches that iterative goal setting, or making short and long term and periodically reevaluating your success, increases our sense of efficacy. Belief in personal efficacy is not a Pollyannaish mind-set such as “I believe, therefore, I achieve.” The most functional belief system for undertaking difficult tasks combines realism about tough odds with optimism that one can beat those odds through self-development and perseverant effort. A resilient sense of efficacy provides the need-

ed staying power" (Bandura 2016). A fictional representation of people facing and overcoming challenges is itself a climate solution.

Solutions stories are hopeful, courageous and funny, demonstrating strategies for how the issues are solvable. Solution stories are specific to a new era in which the problem we face is unprecedented - a rapidly shifting climate. They use humor to help people adjust to new conditions and empathize with each other in problem solving tricky situations. Anxiety reduces participation in climate change mitigation activities. Comedy, especially positive humor, can successfully "soften" scary topics. Making the scope of the problem smaller and the solutions more do-able will provoke interest and engagement in the tasks needed to mitigate climate change.

Stories providing examples of climate solutions being easy, fun, and popular would be ideal (Maibach 2019). We need to switch the message of dystopian films like The Day After Tomorrow (Emmerich 2004), that "Climate change is huge, scary and inevitable," to the message that "We can solve this, and here's how," like the collective advocacy Earth music video by Lil Dicky (Tierney and Heller 2019). Best practice bounces these stories between formats and audiences to reinforce concepts, making them "simple clear messages, repeated often, by a variety of trusted sources," (Maibach 2019). Stories that model how easy and inspiring it is to mitigate climate change might include fictional examples in which characters vote for candidates that support clean energy. Ideally, entertainment programs connect viewers directly to actual social programs that increase voter participation. As Andrew Law, the executive story editor at The Good Place observes, "What this show is about, at its core, is making each other better as a group" (Hanson 2019). Modeling collective efficacy becomes the new narrative structure. These uplifting and funny stories have the commercialization potential to reach broad audiences. Solutions stories begin today, with what's available right now and guide us to a sustainable world. (Figure 2)

Comedy Framing

Fear and humor play integral roles in audience engagement with climate change. Representations of climate change need to be grounded in present realities, neither separated by time and space nor exaggerated (Sakellari 2015). Fear does not motivate long-term behavioral changes towards pro-environmental behaviors (Sakellari 2015). Due to the possible catastrophic outcomes of climate change, mental health impacts, like anxiety (Melillo et al. 2014) paired with fearful framing of the issues, reduce enthusiasm for media content about climate change as well as reducing participation in climate change mitigation activities (Doherty and Clayton 2011; Clayton et al. 2013), and anxiety impairs climate change mitigation behaviors (Doherty and Clayton 2011; Morley Rolls 2013). Comedy, especially positive humor, can be successful in "softening" scary topics (Samson and Gross 2012). Making the scope of the problem smaller and the solutions more do-able is likely to provoke interest and engagement in daunting tasks, such as climate change mitigation behaviors (Doherty and Clayton 2011).

One of the founding tenants of the entertainment-education is that the narrative content needs to be culturally representative of the target audience; for Americans now, this means com-

edy (Ryan 2016). Comedy helps make climate change approachable, reducing fear and anxiety (Bore and Reid 2014). Television is a primary source for American audiences for climate change information and is influential in shaping national perceptions of the related issues (Boykoff 2008; Boykoff and Goodman 2015). Television comedy, in particular, is a useful tool for broadening audiences for climate change topics (Brewer and McKnight 2015). While there are a few contemporary examples of comedy in science communication (Pinto et al. 2015; Riesch 2015), there is room for further experimentation, especially using comedy within narrative fiction (not stand-up comedy), for science engagement. For all of these reasons, this chapter's proposed entertainment-education about climate change is framed as a comedy.

Creating stories which model climate change solutions in a context that is funny and engaging, which model specifically how to do mitigation behaviors, increases perceptions of self-efficacy regarding climate change mitigation behaviors, and increase the perception that we can reduce our carbon dioxide emissions and reduce the overall harm caused by climate change. Intrinsic reinforcement, such as perceived choice, competence, and community will be used as rewards, rather than external rewards, such as money (Clayton et al. 2013). "Some behaviors are avoided because people believe, rightly or wrongly, that they do not know how to perform them. In these cases, behavioral skill training is more important than encouragement. People may need to hear how to reduce their carbon emissions, for example, rather than just being exhorted to do it.

Entertainment-education

While solutions stories are conceptually applicable to many types of content, we would like to propose that entertainment-education, an established health communication mechanism, is an ideal vehicle for conveying these messages. Entertainment-education is a fully integrated communication campaign that uses a narrative story (frequently broadcast via television or radio) as one piece of a larger communication strategy to build audience engagement around important topics of public concern. Entertainment-education narratives are designed to deliver accurate information from reliable sources and model desired change through parasocial interaction, character identification, self-efficacy, and the mediation of interpersonal communication (Singhal and Rogers 1999; Singhal et al. 2004; Singhal 2013; Singhal et al. 2013). Entertainment-education involves production methods for long-running multi-episode narratives or serial dramas and are grounded in theories of narrative persuasion and behavior change with the explicit aim of promoting pro-social messages (Singhal et al. 2004). These projects were commercially successful and led to behavior changes such as higher enrollment in adult literacy classes, adoption of family planning methods, and gender equality (Nairman 1993; Singhal and Rogers 1999; Singhal 2013; Singhal et al. 2013). Entertainment-education begins with formative research that includes demographic and other pertinent information about the target audience and the desired pro-social behaviors the show will model. This research is used by writers to accurately create characters represent the target populations. Positive characters are modeling the desired behavior, negative are modeling what you don't want to happen and transitional characters are learning the new de-

sired behavior. Fictional narratives are created for engaging cognitively, emotionally, and socially, helping to effect attitudinal and behavioral change among individuals and communities (Bandura 2004; Green et al. 2002; Green et al. 2012; Kincaid 2002). Fictional narratives use implicit persuasion approaches that reduce counter-arguing and psychological resistance (Eveland 2001; Moyer-Gusé 2008). Entertainment-education has proliferated, over the past thirty years, to thousands of projects globally becoming an influential health promotion strategy (Green et al. 2012; Kincaid 2002; Moyer-Gusé 2008; Singhal et al. 2013).

Sustainability themed entertainment-education projects have already been implemented successfully with a broad range of international audiences (Heong 2008; Reinermann et al. 2014; Singhal et al. 2000). Entertainment-education is particularly effective at producing cultural shifts in attitude. It is therefore a well suited mechanism to shape and support personal dialog and engagement with the topic of climate change. Narrative fiction is ideal for engaging with audiences over long periods of time because it maintains audience interest and reduces messaging fatigue. Entertainment-education as a strategy is likely to be effective as a tool for creating healthy long-term behavior patterns for creating cultural resilience. For example, there are many barriers to voting in a US election in support of climate mitigation initiatives and greater public health infrastructure, including: gerrymandering, voter suppression, apathy ("My vote doesn't matter"), and insufficient information. It can be confusing for voters to sort-out which candidates and measures support their values. For instance, ex. the Environmental Voter Project (a non-profit aiming to improve voter turnout of environmentalists) encourages people interested in sustainability issues to vote, but will not recommend what or who to vote for due to its efforts to remain non-partisan. Many organizations do make endorsements yet there remains no "unified" and "easy" resource for climate election support. A "unified" website that provides information on how to vote, with a climate ticket prepared for each district and multiple storylines modeling the desired behavior could increase civic participation in public health. The television production company, Shondaland, launched a wonderful example of multi-platform civic engagement in the US 2018 election by implementing these principles. For example, an episode of Grey's Anatomy prior to the election modeled one character (Joe Wilson) mailing in a co-worker's ballot (Alex Karev) for him then putting an "I voted" sticker on his scrubs. Transmedia coverage on the campaigns' twitter page attached specific information, such as, "If you're in line before the polls close #stayinline." And, the cast and crew of all the Shondaland shows shared their "I Voted" selfies on election day.

Efficacy

To improve efficacy, we are proposing a narrative structure shift from hero/villain/victim cycles to iterative goal setting. Hero/villain/victim cycles are culturally pervasive in media (Karpman 1968). While often entertaining, they can perpetuate real life conflict (Bandura 1978). There is a notable shortage of cultural models demonstrating the range of climate engagement or problem solving behaviors. Therefore, alternative story structures are important to consider when the goal is modeling how social groups can unite in the face of a common cause. One way to slightly

modify the Sabido methodology would be to avoid creating archetypal "bad" characters and place greater emphasis on the positive and transitional characters. This would enable feedback regarding behavioral consequences (e.g., smoking exacerbates asthma) but prevent the trivialization and victimization of an entire group of viewers who may identify with the "bad" character. For example, in Rhythm and Glue, the character Roger starts out as a "negative character" who exhibits a variety of climate denial perspectives (Heald 2017). Instead of portraying him in an exaggerated or overly negative way, the first season aims to establish empathy for him. Overall, he spends more of his time on the series as a transitional character who eventually becomes an ally for transitioning the community to renewable energy, despite having initial motivations that differ from the story protagonists. Efficacy motivates climate change adaptation behaviors (Bandura 2016; Valkengoed and Steg 2019).

Efficacy is achieved through setting proximal and distal goals that are periodically re-evaluated. A sense of efficacy is important at both the individual level (e.g., deciding to assist in a disaster by offering first aid), as well as at the larger, collective level (e.g., voting in favor of public health measures). Individual level actions such as walking, biking, and public transit are sometimes dismissed as "not having a big enough impact" (Lazarovic 2018). However, making and carrying out individual level decisions both supports a community's overall outcomes and provides positive social modeling of the desired behavior. Ideally, one would not attempt to convince one's peers to carry out the behavior, but one would simply model it. For example, riding a bike serves both to eliminate fossil fuel emissions from travel directly and helps demonstrate to other people more likely to view riding a bike in one's neighborhood as something normal and fun. One is even likely to receive unsolicited questions about bike equipment and routes from fellow community members. Behaviors that help pool resources and build infrastructure, such as voting for supporting transitions to clean, renewable energy and healthcare resources, benefit everyone (Figure 3).

Empathy

Empathy as a skill reduces conflict and helps individuals navigate the complex decision making processes of attempting to manage limited resources. There are many tactics for teaching empathy, but one especially useful strategy involves a simplification of Nonviolent Communication (Rosenberg 2015). Empathy communication is divided into four parts: Observations, Feelings, Needs, and Requests. Observations include what one sees or hears, as if one were viewing a video. Requests, which must be specific and do-able, can be requests for either action or connection. An example of an action request could be, "Please turn down the temperature on your thermostat," rather than, "Please reduce your family's energy consumption." The action request should include specific instructions for how the task can be accomplished, including guided mastery through social modeling. The action request should be followed by a connection request. Connection requests provide an opportunity for feedback, such as: "Are you getting stuck? Do you need help knowing how to turn down your water heater thermostat?" Some individuals will require new skills to experience success, as well as access to troubleshooting resources.

Viewing empathy as a skillset that can be taught through a formulaic structure (i.e., making observations, expressing feelings, stating needs, and making requests) has important advantages. In disasters, for example, when people are experiencing increased stress, having a reservoir of tools - such as empathy - or managing conflicts improves the efficiency and effectiveness of responses. Practicing these skills regularly establishes cultural patterns that make these responses "easier" under duress. Modeling the practice of conflict resolution skills is a tool for building cultural resilience (Figure 4).

Transmedia

Transmedia storytelling uses narrative elements creatively coordinated across different communication platforms to build a story world and enrich the audience's entertainment experience (Jenkins 2007). Transmedia storytelling holds unique advantages for reaching and engaging audiences from otherwise fragmented media markets to participate in the converging popular culture (Jenkins 2006; Jenkins 2007). Each communication platform carries the story independently but the interwoven tapestry is designed to make for a richer whole, deepening the audience members' relationship with the characters, the plotlines, and the issues (Davidson 2010).

Transmedia extensions provide specific, detailed information in an entertaining format, making the information interesting, relevant, easy to connect with, and tie directly into peoples own lives. Transmedia tie-ins provide details for "how-to" do the various tasks in a way that relates them directly to characters in more specificity than is appropriate within the narrative directly. Brazilian telenovelas establish precedents for audience participation and script modification for creative societal discussion through television media. These programs include social marketing inserted into narrative programming, similar to conventional product placement, but with prosocial messages instead of commercial products, and definitive endings that permit narrative closure. "Brazilian telenovelas are created in a cyclical, continuous manner with ongoing external, diverse inputs from organizations, the government, and the audience. Brazilian writers, producers, and directors write and shoot episodes for a telenovela only a few weeks before they are broadcast. This process allows for last-minute changes, reflects new social trends, and includes current political events. The storyline and social merchandizing consistently evolve due to community input primarily through audience ratings and focus group interviews" (Pastina et al. 2004). Brazilian telenovelas provide an example of responsive, open-genre media and demonstrate an ideal communication mechanism for facilitating a real societal dialog connected to civic engagement towards social and personal improvement. These stories can be interwoven as a network, reducing the redundancy and cost of producing and directing people to the "how to" information, by connecting it through a unified hub. Ideally, these solutions stories are iterative, evolving real-time cycles supporting our evolving climate and communicating with audiences both about current community needs and providing updated research-based support (Figure 5).

American Climate Change Beliefs

While these solutions story tactics broadly apply to many target audiences and behaviors, we provide an example focusing on mainstream American audiences. While climate change and global warming are distinct, yet related issues, tracking public option and perceptions of them helps build our understanding of possible target audiences and story framing of these issues (Roser-Renouf 2015). Such as, although a majority of Americans already think that global warming is happening; very few discuss it with friends and family (Leiserowitz et al. 2015). Also, despite the general awareness about climate change, important misunderstandings persist. For example, Americans often perceive climate change as having limited personal relevance (Brechin 2003; Lorenzoni and Pidgeon 2006; Maibach et al. 2015; Reynolds et al. 2010). Climate change is an emotionally charged subject, and peoples' beliefs and experiences strongly shape perceptions of climate change (Leiserowitz et al. 2015; Moser 2010).

The most effective way to interact with public audiences is through an "engagement model" (Stilgoe and Wilsdon 2009) that conveys scientific information while also addressing issues of ethics and public trust. In short, despite the polarized political discourse on climate change, most Americans now seem to accept the basic tenets that climate change is real and are even willing to support some form of action to address it. However, they struggle to grasp the dimension and timeliness of the threat and have difficulties seeing that they have a personal role in addressing it. For many Americans, the question has shifted from "does it happen" to "what can or should I/we do to address it"? It is, therefore, our job as communicators to assist in building efficacy at the component skills (Figure 6).

Rhythm and Glue as a Solutions Story Example for American Climate Communication

To provide an example of what a narrative approach to climate communication could look like, we've proposed Rhythm and Glue. The story emphasizes personal and collective efficacy and aims to improve public receptivity via layered examples regarding how climate change is already affecting the health of Americans while modeling how effective actions can be easy and fun.

In the serial comedy-drama, Rhythm and Glue, a community collaborates to build a more sustainable city. Comedy, romantic entanglements, and career advancement anchor the plot, while real-time audience participation drives engagement with sustainability topics. Each season presents an overarching climate change issue. Season One focuses on transportation and the current health effects of climate change, with subsequent seasons addressing; energy, water, food, and waste. The show highlights the day-to-day realities of climate change facing residents of the United States – and role models realistic solutions and behaviors that citizens can take to mitigate those effects for themselves and their communities. Successful entertainment-education programs, public heath communication techniques are applied to climate change mitigation to improve the rate of cultural adoption.

Real-time audience participation shapes the story's conflicts and resolutions engaging a national conversation about how we can collaborate to mitigate climate change. The show provides a model for transitioning sustainable urban transportation internationally and creates a national conversation with a variety of stakeholder perspectives. As a comprehensive media platform connects viewers with a network of organizations supporting the actionable behaviors that the audience can take locally to mitigate climate change to increase the capacity of existing sustainability programs.

Story Engine

We propose a fixed narrative structure with placeholders for real-time audience participation to facilitate a national conversation through the microcosm of the show. The pilot sets up the basic story and establishes the characters.

All further content has two sections:

- Fixed story checkpoints, revolving around the characters romantic entanglements and career advancement.
- Flexible storylines that incorporate audience participation through transmedia elements. These areas give the audience an opportunity to share their successes and frustrations with climate change mitigation activities. These sections relate to social and engineering challenges experienced by show viewers. Through partnership feedback, we can efficiently identify existing bottlenecks to social-environmental change.

Interspersing these two elements, we build an architecture that allows for narrative character development, while still supporting a real-time national dialog.

Teaching efficacy, the show uses iterative goal setting as a story structure. The characters start with small individual level decisions (learning active and public transit) and as they gradually gain skills, the level of social complexity at the behaviors increases (such as collaborating to implement municipal scale planning). While the characters experience temporary setbacks which lead story conflicts, the trend lines in these characters development gradually trend upward as they gain personal and collective efficacy, building complex, competent characters modeling increasing community resilience.

Transmedia extensions for a program like this include "how-to" videos of characters performing each of the desired tasks (learning to use active and public transit, civic participation, community building activities) while connecting audiences to other programs and detailed information about climate change. For example, a weathercaster character links to climate and weather information sources such as the Climate Central, Climate Matters program (Climate Matters 2018) (Figure 7).

Solutions Stories as Applied to Disaster Preparedness

Solutions to reduce the harm of disasters include: skills for emergency medical treatment, preventative public health measures, resource management skills, and social/emotional resilience training. Medically, we can provide social modeling of first aid training and triage techniques to share how to care for each other in a disaster. For mental health support, psychotherapy/counseling and peer-to-peer empathy can be modeled through media to provide concrete examples of healthy social strategies. Preventative public health measures include: clean air policies (such as investment in renewable energy), municipal water management, active and public transportation (USGCRP 2016), eating healthy local foods, regular vaccinations and hygiene practices like hand washing and access to toilets. Many of these have co-benefits which improve short term, long term community and personal health. For example, active transportation provides regular exercise which improves individual health as well as reduces the overall air pollution in the community. Community disease prevention measures, like access to toilets, hand washing, and vaccines are grouping points in Healthy Cities plans which require continual reevaluation and continuous public buy-in investment (Rydin et al. 2012). Infrastructure such as water, power and supply chains often breaks in disasters. Therefore teaching staff how to maintain medical treatment in disasters, functioning with limited resources and without technology provides resilience (Luber and Lemery 2015). Social modeling should include resource management techniques, such as water treatment procedures and how to prioritize limited resources through clear communication and collaboration creating cultural precedence for these skills. Social/emotional skills such as empathy, check-ins add embedded emotional resilience techniques. Many of the individual solutions will vary by region, so providing many specific interrelated examples is important. Solutions stories can be crafted to convey all of these individually, and also some tools such as entertainment-education methods can creatively interweave them to teach many of these in parallel. Arvind Singhal proposes using Positive Deviance to identify the successes of outliers who have already found solutions to complex problems by overcoming great odds and subsequently modeling that behavior for the rest of the at risk population (Singhal and Dura 2017). Communication of solutions stories can be used to amplify the successful techniques of these Positive Deviance examples, shifting them into culturally normative practices.

There is ongoing research in social resilience strategies, which seems to unify under "hope" (Cousin-Frankel 2018). Social resilience appears to be a complex, multifaceted issue where we need to be simultaneously addressing individual, family, and community levels. A strong, "sense of agency, or control over one's fate," helped children transcend difficult circumstances (Underwood 2018). Camaraderie and a perceived ability to adapt to stressors were predictive factors in recovery (Servick 2018). While research on resilience strategies is still ongoing and there's much more to learn as we refine these techniques, continuing to study and then iteratively feed the recommendations from these studies into media products will support the cultural integration of disaster preparedness solutions.

An example of applying a solution story to teach disaster preparedness involves a proposed subplot in Rhythm and Glue, in which several of the characters work in a medical office. One of

these characters, a medical assistant, decides to help the office go "green." To achieve this, the character faces and overcomes bureaucratic challenges while also forming new friendships and gradually building self-confidence. Over the course of episodes spanning several seasons, the medical assistant builds a career that includes taking on a public health advocacy position. With the help of new and old friends, the character helps create a community-wide public health program. Transmedia extensions include a variety of first-aid training, community organization techniques, and tools for advocacy of public health and disaster prevention planning. We give this sub-plot example to show how real-life programs, such as My Green Doctor, which assists healthcare professionals in implementing environmental practices (My Green Doctor 2018), can be incorporated. Specific emergency medical training would be incorporated throughout, with a massive fire as the primary conflict in Season Six, in which the characters implement the training and, together, model the procedures for managing the disaster.

Limitations

It is important to acknowledge the limitations of this work and the constraints of this paper. The productions described are expensive and time consuming to produce (compared to typical science communication budgets). Therefore, scalability is dependent on the creation of active partnerships with existing media production companies. While entertainment-education as a tool-set has proven effective for health communication, the potential for serial dramas to impact widescale climate mitigation actions have not yet been tested at the scale and coordination we are proposing.

In addition, while climate solutions can be framed within a comedy context, the consequences of climate change are serious. Climate solutions such as using renewable energy sources, engaging in active transportation, eating local food, improving hygiene practices, and strategies to increase social support should be framed as "easy, fun and popular" (Maibach 2019) and the overall tone of the artwork be kept light, yet it is important to interweave subplots addressing the effects of climate change (e.g., the current health impacts of extreme weather). Finding this balance artistically is nuanced, and may be considered a potential constraint of this work. Iterative content evaluation can provide constructive feedback to measure and improve audience interaction with media products and advise media production. Stories illustrating role models capable of completing difficult sustainability tasks must demonstrate not only their courage but also their vulnerability (Brown 2019). Such examples of persistence in the face of challenges create a cultural reservoir of knowledge that viewers can model.

Conclusions

Despite the global evidence showing that entertainment-education stories are effective at changing behavior, they have not yet been created in the U.S. for climate change. This chapter propos-

es that Solutions Stories are an innovative vehicle for teaching collaboration and resilience strategies with the potential to reduce the harm from extreme weather disasters caused by climate change while also better preparing communities to respond to them when they do occur. There are nearly an infinite number of possible Solutions Stories capable of pertaining to a myriad of target audiences while teaching a variety of resilience strategies.

The main lessons are that

- We can use established entertainment-education procedures to create engaging content to reduce the harm from climate change. There are enormous, undeveloped areas here for expanding content creation.
- Switching from hero/villain/victim cycles to collective advocacy/iterative goal setting story structures will improve our cultural capacity for solving complex social and environmental problems efficiently (Figure 3).
- Comedy framing and setting stories in the present day with a public health focus that climate solutions will improve adoption and cultural relevance of climate stories.

Organizing efforts for collaborating to create a system of content creation that supports climate change mitigation will improve the efficiency of content production. Future prospects hopefully include the rapid development of the show Rhythm and Glue, expanding into both a myriad of related content developed for other target audiences and regions as well as the application of these principles into established shows to create a unified team of media increasing the rate of sustainable cultural practice adoption. The checklist (Figure 2) is a tool for creating stories that frame climate communication set in the present day, with characters modeling efficacy at problem solving climate solutions through engaging in do-able behaviors. Each story can teach specific interventions that become interwoven building an effective communications infrastructure. Employing this set of storytelling techniques will assist cultural adaptation patterns and reduce the massive, deleterious effects on our communities caused by the negative physical and mental health impacts caused by climate change. We can do it, let's get started.

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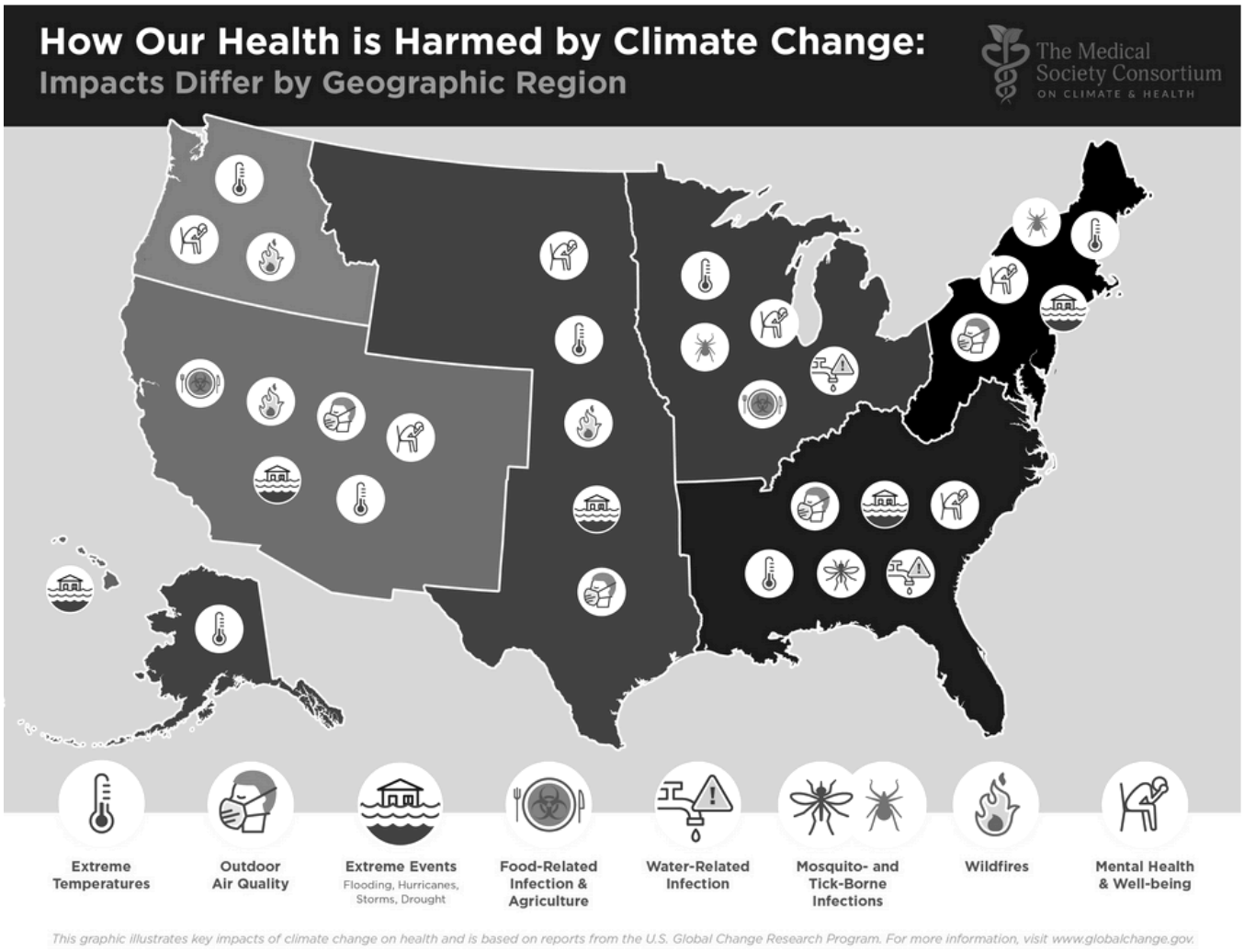

Fig. 1 How our Health is Harmed by Climate Change (Sarfaty et al. 2017)

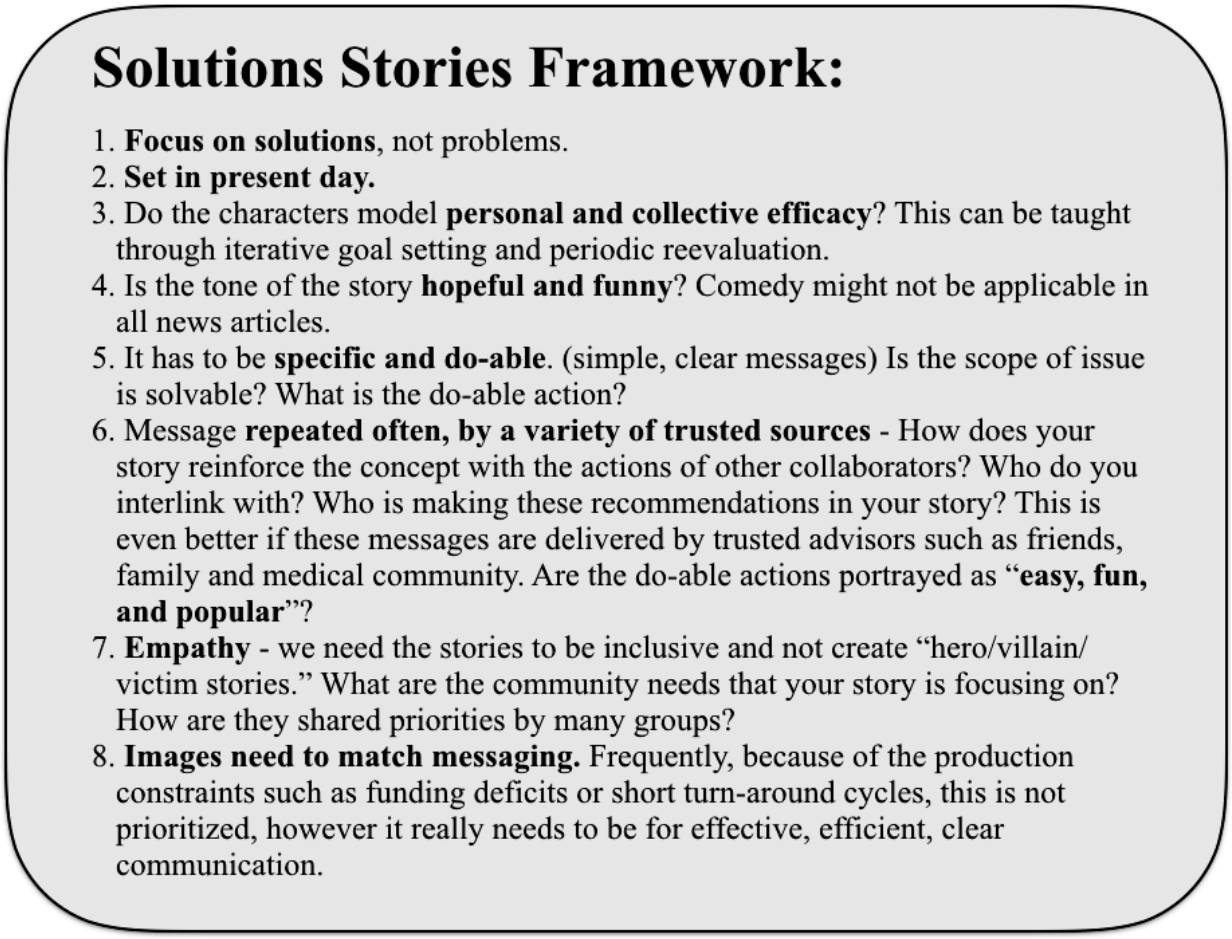

Fig. 2 Solutions Stories Framework

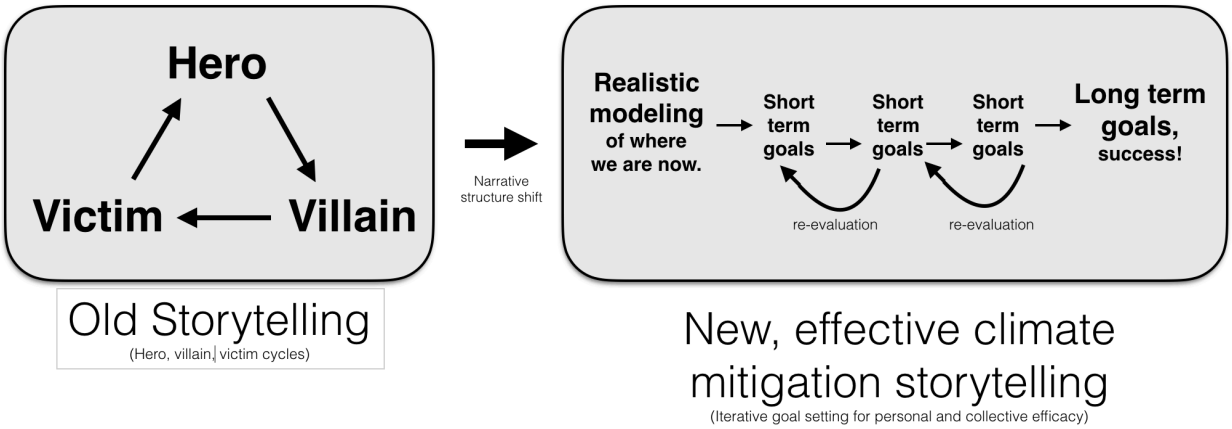

Fig. 3 Solutions Stories switch from a Hero, Villain, Victim drama cycle, which narrative cycle perpetuates conflict to Iterative Goal Setting with narratives focused on personal and collective efficacy at overcoming realistic resource conflicts.

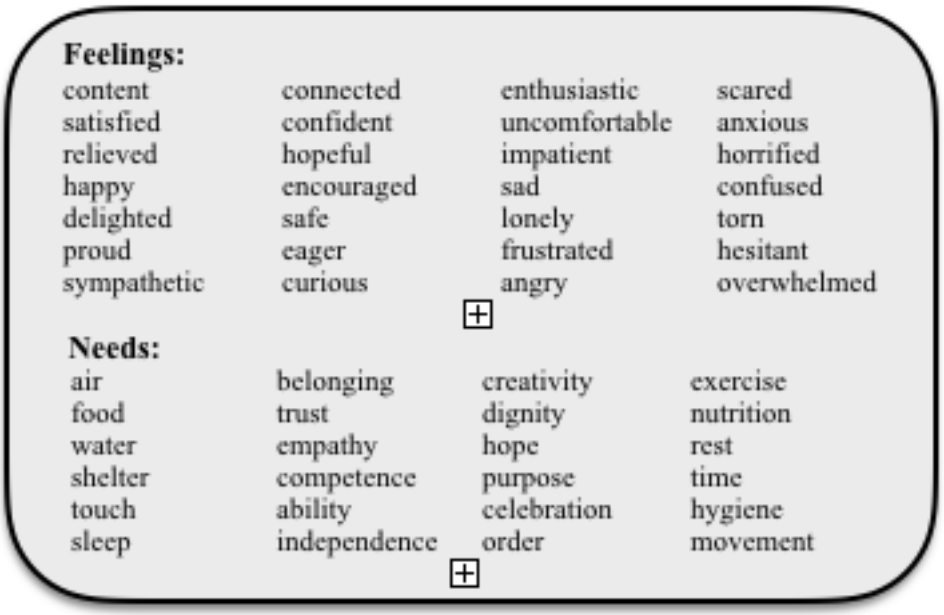

Fig. 4 A sample from the Nonviolent Communication: Feelings and Needs Inventory (Rosenberg 2015)

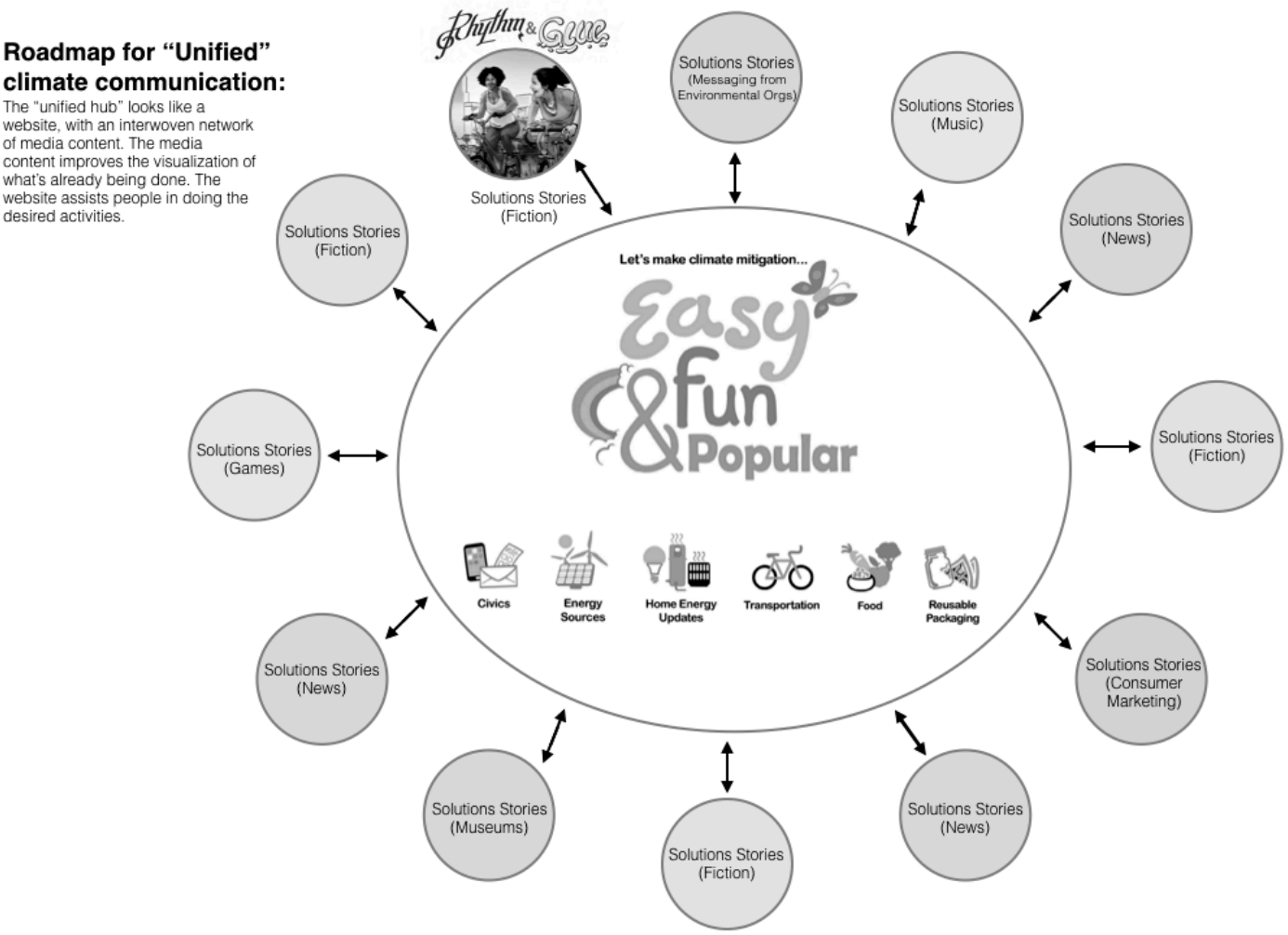

Fig. 5 Transmedia Roadmap for Unified Climate Communication

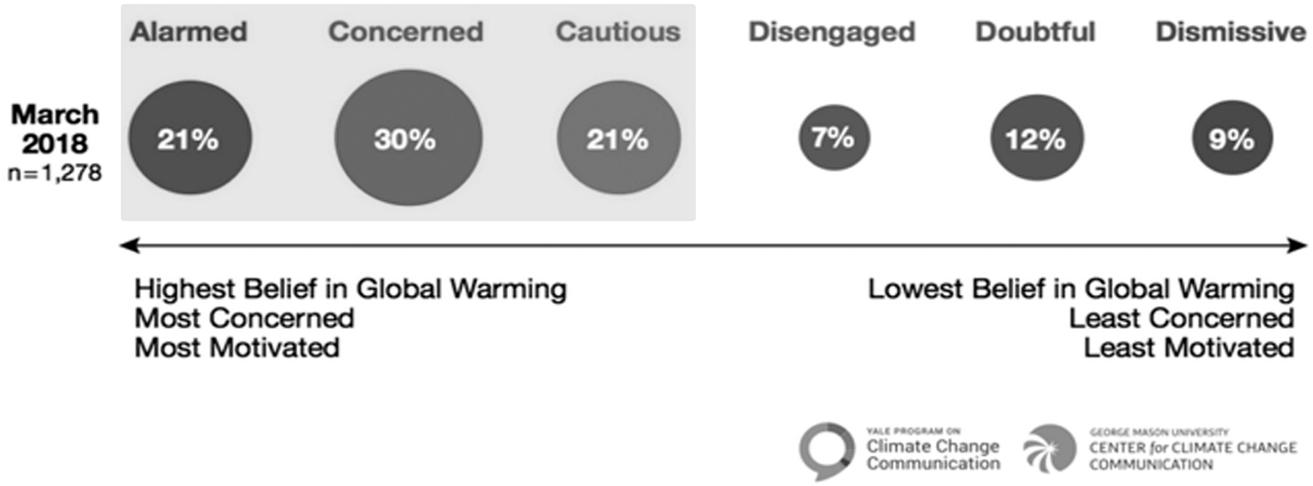

Fig. 6 Global Warming's Six Americas, description of audience perspectives (Roser-Renouf 2015; Yale 2016). The blue areas are our target audiences, with the goal of increasing efficacy of climate mitigation behaviors in those audience segments.

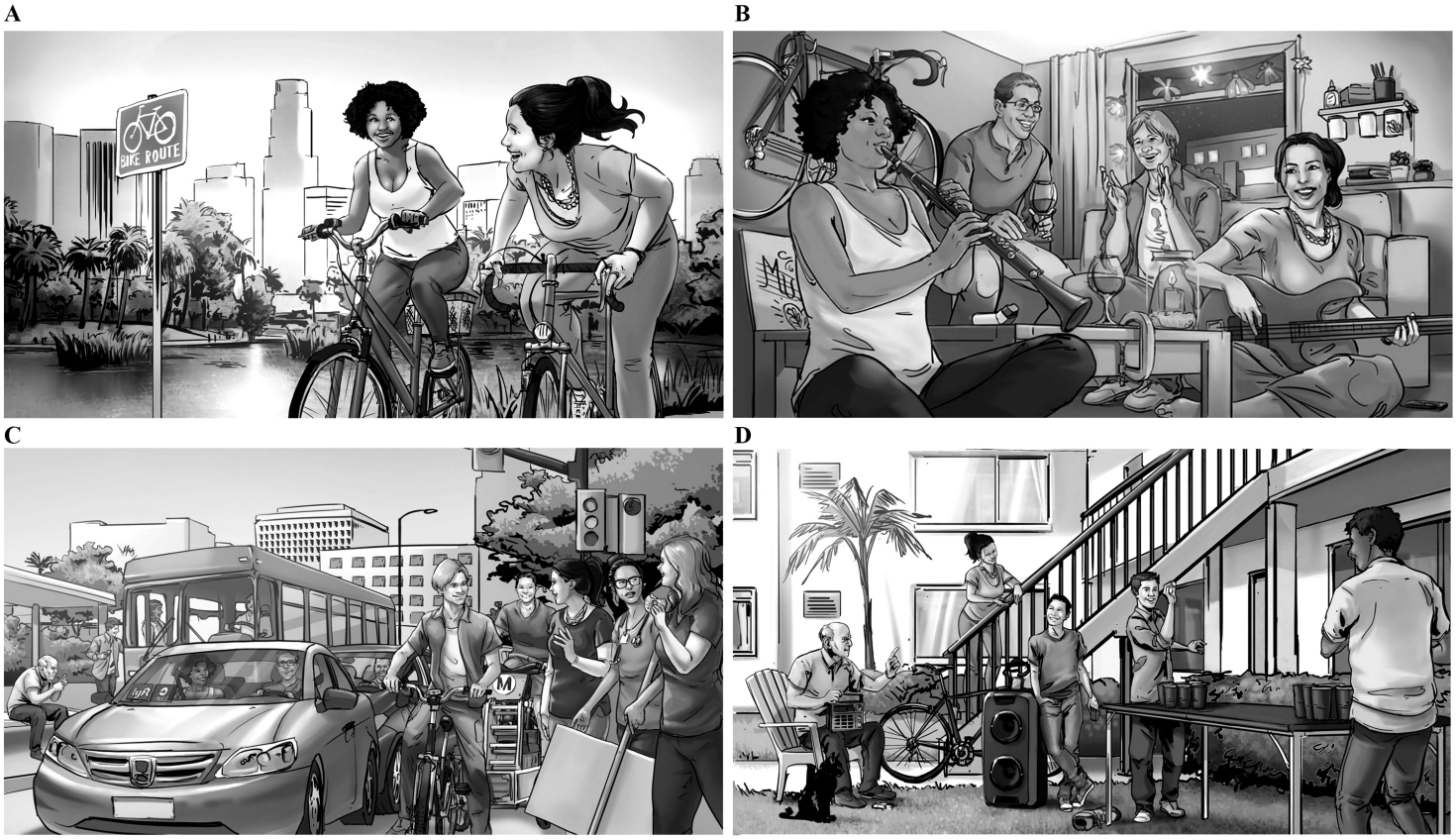

Fig. 7 Rhythm and Glue concept illustrations

(A) Sarah and Jessica exploring Los Angeles together on bicycles. This subplot provides personal and collective efficacy at one of the new skills as well as guided mastery for a complex skill. (B) Jose and Daniel join Sarah and Jessica at their apartment to drink and play music in the evenings. The community music plot thread teaches community building skills. (C) Season One highlights transitions to active and shared transit, including: bicycling, walking, bike share, rideshare, public transit and updates to electrified transit (electric bikes and cars). (D) Andy, Josh, and Matt playing beer pong in their apartment courtyard while Roger scolds them for the noise and clutter. The informal community games evolve within the story into community building opportunities to improve local level discussions and problem solving for climate engagement. These concept images were drawn by Liberum Donum (http://liberumdonum.com/).