

Article

Connecting People with Science: A Proof-of-Concept Study to Evaluate Action-Based Storytelling for Science Communication

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Abstract: Many of the major environmental problems facing society remain intractable because members of the public neither perceive the relevance to them nor how their individual actions might help the situation. Post-consumer textile waste is one such disregarded problem, whereby disposal of waste from the fashion industry, especially the discarding of functional but out-of-fashion garments, releases significant greenhouse gases that contribute to climate change. Here, we used action-based storytelling as proof-of-concept of an innovative way to promote agency for climate action by showcasing pro-environmental behaviour through social modelling within stories. We evaluated the effectiveness of action-based storytelling in evoking agency, self-efficacy, and intention to increase second-hand clothing consumption. This research sought to identify if the choices faced by the story's hero impacted these variables. The research is innovative in its use of a mixed-methods research methodology and community-based social marketing approach. Two focus groups identified consumer barriers to, and motivations for, second-hand clothing consumption in order to inform the development of three action-based storytelling videos (each with a different hero character: (i) a scientist, (ii) an influencer and (iii) students). A quasi-experimental survey evaluated how action-based storytelling and the different story heroes impacted participants' levels of agency, self-efficacy, and intention. Results showed that participants' levels of agency, self-efficacy, and intention significantly increased after watching the videos. Furthermore, the influencer hero was found to have the greatest effect on these variables. This research concludes that action-based storytelling can be an effective communication approach which demonstrates promising results in evoking agency and self-efficacy and increasing the likelihood that consumers will adopt pro-environmental behaviours.

Keywords: storytelling; climate change; social marketing; science communication; second-hand clothing consumption



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1. Introduction

Social and science communication campaigns have long attempted to convey the issue of climate change to the public and encourage them to adopt mitigation behaviours. Although research shows that people's attitudes are shifting towards viewing pro-environmental behaviour as desirable, the research gap that this paper addresses is that their actual behaviours do not yet reflect those changing beliefs [1–5].

The slow uptake of meaningful climate action by consumers, for example, suggests a need for alternative approaches to increase the likelihood of consumers taking action. A number of researchers have suggested that relaying accurate, concise science messages and providing a clear call to action can help bridge the gap between knowledge and action by evoking self-efficacy and agency [6–10]. De Meyer et al. [7] describe this approach as *action-based storytelling* and argue that it may help break down the complexities related to problems such as climate change and stimulate action amongst consumers.

This research addresses a significant research gap in the field of science communication, as identified by Bushell et al. [6], De Meyer et al. [7], and de Vries [8]: how to convert

knowledge transfer into actions and behavioural change. We do this by empirically examining the effectiveness of focusing on action-centric narratives and the person(s) delivering the message in climate change communications.

The aim of this research, therefore, is to provide a proof-of-concept study that evaluates the effectiveness of action-based storytelling using McKenzie Mohr's [11] concept of Community-Based Social Marketing (CBSM). CBSM applies psycho-behavioural insights to message development, taking a pragmatic approach to social marketing and behaviour change by progressing through a strategic five-step process [11]. Our use of action-based storytelling in combination with the process of CBSM is a novel approach to communication that, if successful, could potentially increase the adoption of climate-positive behaviours.

The pro-environmental behaviour used as the focus for this research is the consumption of second-hand clothing. Second-hand clothing consumption (SHCC) is potentially a major way to mitigate the effects of post-consumer textile waste, the disposal of which releases significant greenhouse gases and contributes directly to climate change [12–15]. To date, there has been no research that has tested the effectiveness of action-based storytelling in increasing the adoption of climate-positive behaviours in the context of fashion. Hence, this study not only addresses a research gap when it comes to improving the effectiveness of science communication and social marketing in encouraging behavioural change; it also has relevance for policy development designed to empower consumers to develop agency for climate action.

2. Literature Review

2.1. Review of Past Communication Approaches

Traditional science communication about climate change has typically relied upon knowledge–attitude–behaviour or information-deficit models that present facts about climate change in one message, usually without the presence of a meaningful call to action [6,8,16–18].

Al Gore's documentary, *An Inconvenient Truth* [19], is an example of applying the information-deficit model: it portrayed the dangers of anthropogenic effects upon global warming without a meaningful call to action. Bushell et al. [6] and Bell et al. [20] defined this communication approach as "the Gore narrative", arguing that it is "insufficiently robust" as it illustrates a journey where humanity faces "apocalyptic scenarios" that may be seemingly avoided by using "low-energy lightbulbs" [20] (p. 6). It exemplifies how telling an audience of an impending threat without including instructions on how to mitigate the risk can lead to individuals experiencing conflict between "I should act sustainably" but "I am not sure how", thus leading to action paralysis [8].

The predominant school of thought has been that, to foster climate-positive behaviours, people's attitudes must first change through increasing their knowledge, awareness, and concern [7]. However, models which adopt this traditional communication approach have proved ineffective when it comes to evoking purposeful action [7,21]. Information alone does not translate to behaviour changes [6,22]. Knowledge acquisition is not a straightforward process [23]. Humans include their existing knowledge, biases, and lived experiences when interpreting any information they receive. Furthermore, the notion that beliefs correlate to behaviours only holds when attitudes are strong, and behaviours are believed to have a significant mitigation effect [7].

Additionally, the complexity of the science about climate change and the "heaping of irrelevant details" (p. 10) [8] in communications about it can lead to backlash from the public. The result is a gap between the awareness of climate change and individual action, with people associating climate change with a distant and impersonal threat that is irrelevant to them [10,24]. As a consequence, individuals can deflect responsibility to governing agencies, corporations, and others.

2.2. Action-Based Storytelling

Storytelling is an important communication device as it can deconstruct complex ideas and represent them as memorable narratives that illustrate specific experiences as they relate to different people [6,8,23,25,26]. Stories can also be an effective tool for persuasion due to their ability to influence emotions, transport audiences to different scenarios, and create influential role models. In doing so, they have the potential to encourage behaviour change through social modelling by developing critical self-beliefs that can drive the adoption of pro-environmental behaviours [8,24–27].

Action-based storytelling, when used within the context of climate change, does not try to evoke concern by presenting scientific facts; instead, it acknowledges the problem of climate change and provides solutions to solve the problem [7]. To encourage agency and self-efficacy, stories must present concrete actions that solve climate-related challenges in a localised, present-day context, using specific characters as role models (or heroes) that are relevant to the audience, who must perceive these actions as “realistic, doable and meaningful” [7].

2.3. Agency and Self-Efficacy

Agency and self-efficacy are important factors to foster in people to engage in climate-positive behaviours [28–32]. *Self-efficacy* is the personal belief that one can effect change through personal and collective action [27,33–36]. It is a performance-based measure of how doable an action (or behaviour) is [37] and plays a central role in regulating motivation [27]. Self-efficacy is embedded in social cognitive theory founded from an agentic perspective [27]. Thus, self-efficacy is the foundation of agency. *Agency* describes the ability to act intentionally to incite a desired consequence [7,38,39].

Intrinsic agency and self-efficacy reinforce that actions are doable and meaningful, making an individual less likely to disengage from acting on issues such as climate change. Research has shown that self-efficacy is a strong predictor of adopting public climate action [40]. By contrast, individuals who deflect responsibility for solving environmental issues have low perceptions of self-efficacy [41].

2.4. Story Heroes

Heroes are cross-cultural symbols that give an audience hope and strength in times of peril [42] and can be a critical component of compelling storytelling. Hero characters help drive the persuasiveness of stories through heightened character identification [24,43] and social modelling [27]. Character identification describes the level of involvement an audience member assigns to a character [44]. Greater identification with a character increases the audience members’ likelihood of adopting the attitudes expressed by the character [45,46]. Social modelling works similarly, whereby model figures communicate knowledge, values, and behaviours that elicit personal and social change within the audience [27]. Social modelling is most powerful when the hero character is socially attractive, perceived as being like the audience’s demographic, and demonstrates the beneficial behaviours [27].

Social modelling works because heroes can act as role models and beacons of hope for audiences. Heroes become symbols of optimism and courage in the face of complex challenges [47]. Heroes and their stories fulfil critical cognitive and emotional needs of the audience by providing wisdom, hope, and inspiration [48]. These characteristics illustrate how heroes can potentially play a critical role in evoking agency and self-efficacy within an audience.

In the context of science communication about climate change, story heroes are often portrayed by a scientist or expert, such as in “the Gore narrative”. Bushell et al. [6] argue that scientists are inappropriate messengers as they give the impression that they know better than the audience, who should do as they advise [15]. By contrast, heroes who are part of the audience’s society may have elevated amounts of persuasive power when it comes to spreading pro-environmental narratives [49].

2.5. Post-Consumer Textile Waste and Second-Hand Clothing Consumption

Domina and Koch [50] describe *post-consumer textile waste* as garments that are surplus to an individual's requirements and discarded, ending up in a landfill site. Worldwide, nearly 60% of the 100 billion clothing items produced each year end up in landfill less than a year after manufacture, with the average garment lifespan being a mere 3.5 years [51]. For example, a small country like New Zealand—with a population of only 5.1 million people—imports more than 380,000 tonnes of apparel products each year [52]. Half of these annual clothing imports end up in landfill sites after only three years of use [53]. Such textile waste accounts for four percent of all the waste in New Zealand and 22% of mixed waste on a global scale [4,53]. When fabric decomposes, it releases an amount of greenhouse gases of nearly three times its weight, directly contributing to climate change [53]. The New Zealand context is useful for illustrating the scope of the environmental impacts associated with the fashion industry. Despite New Zealand contributing very little to clothing production, the nation is a large consumer and disposer of garments.

SHCC is one way to extend the garment lifespan and to reduce the amount of post-consumer textile waste in landfill [54]. Moreover, sustainable fashion consumption practices, such as buying second-hand clothing, have the potential to reduce nearly a quarter of the fashion industry's emissions [2]. McKinsey and the Global Fashion Agenda [2] assert that improved garment recycling could abate 18 million tonnes of annual greenhouse gas emissions.

2.6. Second-Hand Clothing Consumption Behaviours

It is important to note that the relationship between individuals and fashion is complex. This relationship involves many social and psychological factors that can influence how people perceive sustainability and fashion in tandem [3,55,56]. However, when looking at the existing literature, six motivations for SHCC have been identified: economic drivers, hedonic motives, intrinsic self-enhancement, uniqueness, sociability, and personal values [55,57–60]. In addition, the literature also reveals seven persistent barriers: health and hygiene concerns, poor shopping experiences, social consequences, lack of ownership, quality, availability, and economic deterrents [3,61–63].

3. Materials and Scope: Conceptualisation of Research

The objectives of this research were to (i) test the effectiveness of action-based storytelling in evoking agency, self-efficacy, and intention to increase SHCC and (ii) determine whether using different hero characters can change outcomes. Seven research questions were used to explore the research objectives:

RQ1: “Does action-based storytelling impact consumers’ level of agency?”

RQ2: “Does action-based storytelling impact consumers’ level of self-efficacy?”

RQ3: “Does action-based storytelling impact consumers’ intention to shop second-hand?”

RQ4: “Do story heroes impact consumers’ level of agency?”

RQ5: “Do story heroes impact consumers’ level of self-efficacy?”

RQ6: “Do story heroes impact consumers’ intention to shop second-hand?”

RQ7: “Which types of story heroes are most effective in impacting personal levels of agency and self-efficacy?”

This study is an exploratory proof-of-concept pilot that builds on the research of De Meyer et al. [7]. It is our assumption that action-based storytelling will have a positive effect on consumers’ levels of agency, self-efficacy, and intention. Regarding the effect of story heroes, it is our assumption that characters who most resemble the target audience will have the greatest effect on these variables. This assumption is informed by the literature discussing the psychology behind social modelling and character identification [27].

This research uses a qualitative–quantitative mixed-method approach to examine the effectiveness of action-based storytelling and different story heroes in evoking agency, self-efficacy, and intention towards increasing SHCC. It applies CBSM as a methodological guide [11]. The objective of CBSM is to design an effective program that encourages

widespread sustainable behavioural change by methodologically following a five-step process—each step building upon the preceding one. Table 1 presents how each step in CBSM correlates to the stages of the methodology in this research. The target audience for the action-based stories focuses on students attending a New Zealand university in the South Island. The university was chosen as the SHC store featured throughout the message of communications was an on-campus student-led shop. In terms of the criteria, the sample population for both focus groups and the quasi-experimental survey was open to any current student at any level of study from any academic background. These attributes were selected to reflect the diverse population of the student body.

Table 1. Research design measured against CBSM.

Steps in CBSM		Stages of Methodology
1.	Select behaviour to promote	Literature review surrounding SHCC (see: Section 2. Literature Review).
2.	Conduct barrier and benefit research regarding desired behaviour change	Qualitative data collection using focus groups (see: Section 3.1. Focus Groups: Sample, Procedure, and Data Collection).
3.	Develop strategy to overcome barriers and increase benefits	Development of action-based climate stories (see: Section 3.2. Video Development and Materials).
4.	Pilot strategy	Quasi-experimental survey to measure effectiveness of action-based storytelling (see: Section 3.3. Survey: Sample, Procedure, and Data Collection).
5.	Evaluate strategy	Analysis and discussion of survey results (see: Section 4.3. Proof of Concept Survey and Analysis of Action-based Storytelling Effectiveness).

First, the end-state, non-divisible behaviour of shopping for clothes at a local thrift was used as the first step of CBSM: selecting which behaviour to promote [11]. Second, two qualitative focus groups were studied to understand existing clothes-shopping behaviours and the associated barriers and motivations to SHCC. This component is in line with step two of CBSM: conduct barrier and benefit research regarding desired behaviour change [11]. Focus groups were utilised as they enable researchers to delve deeper into consumers' perceived motivations and barriers towards SHCC. The open discourse enabled the researcher to probe, follow up, and clarify participant statements. As such, the nature of the focus groups for qualitative research provided a richer understanding of consumer behaviour surrounding SHCC.

Findings from the focus groups informed the development of three short videos. These videos were conceptualised and produced according to the principles of action-based storytelling and agency as a story structure [7]. Video production meets the third step in CBSM: developing strategies to overcome barriers and to increase the benefits of the desired behaviour change [11]. The effectiveness of the videos was evaluated through an online survey using Qualtrics Software June 2022, which collected qualitative and quantitative data. The videos were embedded into the survey, and each participant was allocated one of the videos randomly.

Data collection included measuring participants' levels of agency, self-efficacy, and intention to shop for second-hand clothes (dependent variables) before and after viewing the video. The survey accounts for the final two steps in CBSM: piloting and evaluating the strategy's effectiveness [11].

These two final stages involving the survey and evaluation provided the main findings to answer the research questions. However, it is essential to work through the initial stages systematically to maintain the integrity of the CBSM behaviour-change approach. Such

stage-work is critical for building a holistic understanding of the issue from the audience's perspective and to develop the stories to answer the main research questions. Hence, all stages are presented in further detail in the following sections.

Participants in this study were recruited from students at the University of Otago who had purchased clothing within the past six months. They did not need to have a personal interest in fashion or sustainability. University of Otago Ethics approval was obtained before conducting the research and all participants provided written consent. Participants received a supermarket voucher to compensate for their time.

3.1. Focus Groups: Sampling, Processing, and Data Collection

Stage two of the research design involved two focus groups, where the objective was to identify and understand influences, motivations, and barriers to SHCC.

Convenience sampling was used to recruit participants through an advertisement on the University Sustainability Office's Instagram page and by word-of-mouth. Participants were then filtered into two focus groups through purposive judgement sampling [64]. Participants selected from the University Sustainability Office's Instagram advertisement ($n = 4$; 1 male, 3 females) were considered to be "sustainability-focused consumers", while those recruited by word-of-mouth ($n = 6$; 2 males, 4 females) were considered "general consumers". All participants were between 21 and 24 years old.

Semi-structured, open-ended questions were used to guide the focus groups, allowing the conversations to flow organically. One of the authors (MS) was the moderator and probed participants when necessary to draw rich insights. Step two of the CBSM informed the discourse structure for the focus groups, whereby data were sought about the influences, barriers, and motivations to SHCC. Each focus groups lasted between 60 and 90 min. They were conducted via online interviews using Zoom on 28 and 29 April 2022, respectively. Both groups were audio-recorded to enable accurate and unbiased data collection. The recordings were transcribed immediately after each focus group finished. The transcripts were then coded and thematically analysed following the protocols recommended by Braun and Clarke [65], whereby six coding rounds were used to refine the data corpus into a workable data set. Four rounds of theme development then helped refine, define, and characterise the final themes. As the themes derived from each focus group were essentially the same, the responses from the focus groups were treated together for the purposes of the thematic analysis.

The underlying epistemology applied to this thematic analysis follows a constructionist method rooted in a realist approach. This approach assumes that one's perceptions provide direct access to reality [66]. A deductive approach was then used to view the data through the lens of CBSM. This lens enabled existing theory to inform the coding and theme development. Themes were developed using semantic and descriptive analyses. This analytical approach ensures that findings reflect the participants' lived experiences as accurately as possible [66]. Finally, in writing up the thematic analysis, the findings were referenced against the existing literature to support the rigour and validity of the qualitatively derived construct.

3.2. Video Development and Materials

We used the findings from the focus groups to inform the production of three short videos that were examples of action-based storytelling. Each video storyline highlighted pertinent barriers and motivations revealed by the focus groups in order to demonstrate that SHCC is beneficial to both oneself and the environment and is easy to enact. The production of the videos fulfilled step three of CBSM: developing a strategy. A keyframe analysis [25] was used to demonstrate how the focus groups informed story development.

These videos followed the "agency as a story" structure described by De Meyer et al. [7]. Each video was identical in storyline, stylisation, and overarching call to action to mitigate uncontrolled variables, with the only differentiating factor being the identity of

the story's hero. The videos were intended to evoke agency and self-efficacy within the audience and increase their intention to shop for SHC.

The hero of each video was portrayed as either a scientist, an influencer or a student. The use of experts in “the Gore narrative” inspired the scientist character, who acted as a comparative element to the other heroes, namely the influencer and the student, who were derived from the focus group findings.

The videos were developed, filmed, and produced over three weeks (1–19 June 2022). The footage was filmed on an iPhone 11 and edited in Final Cut Pro. Seven rough cuts and rounds of feedback elapsed before the final cuts were approved. The videos were then pre-tested with five members of the sample population to ensure their clarity. Each video was 31 s long and uploaded to YouTube as unlisted content.

3.3. Survey: Sampling, Processing, and Data Collection

An online survey was used to test this proof-of-concept study, enabling collection of qualitative and quantitative data to examine the effectiveness of action-based storytelling (the treatment) [67]. The survey sample characteristics are displayed in Table 2. The survey was promoted through the university student clubs and societies and via a four-day Facebook advertisement. Thus, respondents were recruited through a convenience sampling method. Respondents could not progress through the survey before reading a short information paragraph (extracted from the ethics form) and confirming that they consented to participate in the research.

Table 2. Survey Participants—Main Characteristics.

Main Criteria		Number of Participants	Structure Ratio
Total number of Participants		216	100%
Gender:	Male	40	18.5%
	Female	173	80%
	Non-binary	3	1.5%
Age:	18–25	173	80%
	26–35	28	13%
	36+	15	7%
Education:	Undergraduates	145	67%
	Postgraduates	71	33%

The survey was designed and conducted using Qualtrics software, whereby one of the three videos was embedded into the survey and randomly allocated to each participant. The survey used a 5-step Likert scale to measure the respondents' levels of agency (one's ability to act intentionally to incite a desired consequence), self-efficacy (personal belief that one can effect change through personal and collective action), and intention (likelihood of enacting a behaviour) to shop second-hand (the dependent variables) before and after viewing the video. Survey items to measure agency and self-efficacy were extracted from existing scales to ensure quantitative construct validity. Established scales used in research by Neumann, Martinez, and Martinez [68], and Nelson, Ira, and Merelender [69] aided in the measurement of both agency and self-efficacy. Two items from Doherty and Webler [40] were extracted to assist in the measurement of agency, whilst an item from Bostrom, Hayes, and Crosman [70] was utilised in the measurement of self-efficacy. A simple self-generated scale asking how likely participants were to shop at a thrift store in the future was used to measure intention.

Before the survey was published, it was pre-tested in-house and pilot-tested with a sample of ten participants from the target population and an industry expert.

In addition, open-ended and multi-choice questions facilitated the collection of exploratory data. Such exploratory data included participants' opinions of the video, what they liked and disliked, and what they believed the key messages were. These data provided insights and context to support the conclusions from the quantitative findings.

Data analyses were performed using the statistical software SPSS (Version 27). Paired *t*-tests were used to measure within-participant levels of agency, self-efficacy, and intention before and after video viewing [71]. These tests identified whether the videos had a significant impact on the dependent variables, thereby identifying the empirical effectiveness of action-based storytelling. Additionally, one-way analyses of variances (ANOVA) with post hoc comparisons were used to determine which story hero had the most significant effect on the dependent variables [72]. This analysis compared between-subject results for each dependent variable after video viewing. Finally, the exploratory data provided a descriptive analysis of the results, facilitating deductive reasoning to expand and contextualise the statistical results.

In all, the survey was taken by 293 participants. Data cleaning was then used to remove any inappropriate responses, which included 43 that were incomplete or not completed in the time available, 21 that were not from students and therefore were not part of the target audience, and 13 nonsense responses as evidenced from a series of box plots created for the dependent variables to identify such deliberate outliers. The final number of eligible responses was 216.

4. Results and Discussion

4.1. Focus Groups: Thematic Analysis

The focus group findings revealed four overarching themes and seven sub-themes (as shown in Figure 1) pertaining to SHCC influences, motivations, and barriers.

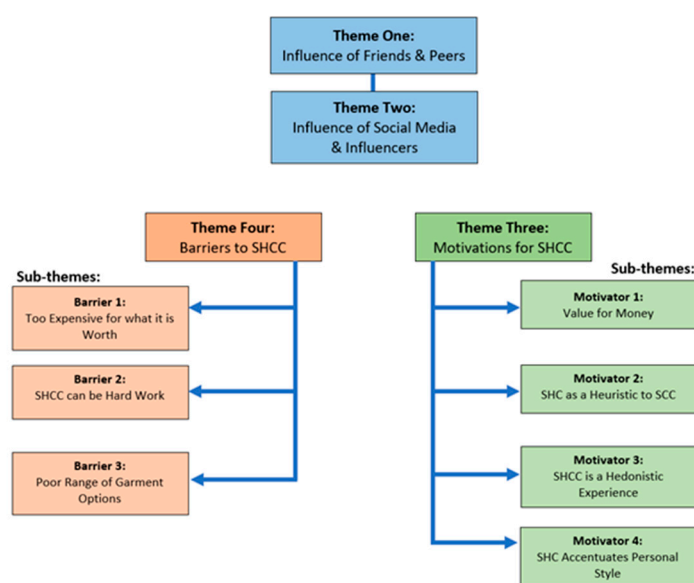


Figure 1. Thematic analysis of focus group findings.

4.1.1. Theme One: Influence of Friends and Peers

The influence of friends and peers acts as a motivator for the purchase of SHC. The focus groups revealed that friends act as a reference group whose opinions are highly valued when deciding which clothes to buy. Peers also act as inspiration for what items participants may consider buying. Peers are an encompassing term for people not personally known to the participants (i.e., strangers on the street). These findings exemplify how social norms and social modelling work in real life. For example, when participants saw friends or peers wearing trendy or specific clothing, it indicated that they should also wear such garments [73]. Seeing friends and peers wearing something provided a reference for what it might look like on oneself. Participants further articulated that such effects of social modelling were stronger when their friends and peers were similar to themselves in terms of looks. *“When you see a real person wearing it, you know like your friends... [or] out in public, you see what it actually looks like... so kind of almost gives you confirmation when you*

see other people wearing it that it would look flattering and also trendy on you." These findings are in line with Bandura's [27] comments on social modelling. This theme also relates to the motivation of sociability cited in the literature. According to Laitala and Klepp [59], McNeill and Venter [55], and Wang, Fu, and Li [62], sociability embodies group belonging, and it involves having friends who shop for second-hand clothes and who view SHCC as a social activity.

4.1.2. Theme Two: Influence of Social Media and Influencers

Like the influence of friends and peers, the influence of social media and influencers also acts as a motivator for the purchase of SHC (see Figure 1 on themes of influence feeding into motivators). Participants expressed how the people, brands, and influencers they follow, and the content they see on social media can influence what they buy and their perception of "trends". This influence was stronger when the influencers or other people were similar to themselves. *"I feel like I see things on Tik Tok, and I don't know, I guess like trends, then I'm like I want to buy that I guess that influences like my perception"*. This theme illustrates how participants are influenced by what and who they see across social media platforms. This theme reflects Moser and Dilling's [15] notion that industry experts resonate with their audiences and is also associated with findings in the literature about social modelling.

4.1.3. Theme Three: Motivations for SHCC

Four critical motivations were acknowledged throughout the discourse: (a) Value for Money; (b) SHC as a Heuristic to Sustainable Clothing Consumption; (c) SHCC is a Hedonistic Experience; (d) SHC Accentuates Personal Style. The identification of these motivation themes is a response to the need to identify benefits and drivers associated with SHCC in line with step two of CBSM.

4.1.4. Motivation 1: Value for Money

Participants are drawn to SHCC due to the ability to find "cool", "branded", or "quality" garments at low prices. Participants expressed that finding such garments at low prices is "thrilling" and feels like a "big win", reducing the dissonance of spending money on clothing. This theme is an external motivation and does not mean that the perception is that all second-hand clothing is cheap. Furthermore, the low prices are a motivation only if the garments are considered valuable to the participants. In this context, valuable garments relate often to branded clothes or clothing of good quality that are sold second-hand for significantly less than their retail prices. *"I think the price is a huge draw because it is far cheaper, and you can find good quality clothing in those stores, which can sometimes be an eighth of the price of what it would be online or new"*.

This motivation echoes findings from Guiot and Roux [57], who showed that such economic drivers motivate SHCC [55,58,59].

4.1.5. Motivation 2: SHC as a Heuristic to Sustainable Clothing Consumption

Participants expressed their belief that SHCC is a sustainable form of clothing consumption. This belief reduces guilt as their purchases do not contribute to "ruining the environment" and is a morally better alternative to purchasing fast fashion. This theme also describes how SHCC reflects a mental shortcut to sustainable consumption in the information age: *"There are all these other ethical sources you can think about in terms of how you are engaging, maybe like in the practice of purchasing [second-hand clothes] it sort of reduces your options in terms of complexity where . . . you're not overloaded with different options"*.

These results correspond to the motivators of personal values and of increasing health benefits to self and the environment that are cited in the literature. Personal values are an umbrella term for ethical and environmental values or morals held by consumers. They encompass clothing reuse, recycling, non-wasteful attitudes, and environmental protection as identified by Laitala and Klepp [59], Sorensen and Johnson Jorgensen [61], and others in the broader literature [57,58,62]. However, this motivation differs slightly from such

literature in that it demonstrates that participants are aware of the importance of sustainable consumption but are not driven to research wider channels for sustainable consumption.

4.1.6. Motivation 3: SHCC Is a Hedonistic Experience

SHCC is like a “lottery”; participants describe the process as “fun”, “satisfying”, and like a “hunt” or “hobby”. Participants also expressed experiencing gratification when they found an item they liked after searching for some time. *“Joy and gratification of finding something really cool in an op shop... honestly the reason that I like op-shopping is for the like process... sifting through every single item of clothing until you finally find something that you quite like...”* These results relate to the hedonic motives described in the literature. Hedonic motives embrace the treasure-hunting aspect of SHCC, which has been described as exciting, fun, and challenging [57,59,62].

4.1.7. Motivation 4: Second-Hand Clothing Accentuates Personal Style

Participants expressed the ability to find “one of a kind” items as a motivation to shop at second-hand clothing stores due to the diversity of clothing available. This process also enabled participants to step away from following trends set by fast-fashion chain stores. *“I’m trying to steer away from trends nowadays... I feel that I’m definitely trying to find my own style and find unique stuff and yeah that’s definitely a motivation for me to go to second-hand stores”*. This motivation closely resembles the motivators identified in the literature as uniqueness and intrinsic self-enhancement. Intrinsic self-enhancement is described by Lunbland and Davies [60] as the ability to create a unique style through SHCC, leading to self-expression and a sense of individuality. Uniqueness as a driver of SHCC is also cited by other researchers such as Hur [58], Laitala and Klepp [59], and Sorensen and Johnson Jorgensen [61].

4.1.8. Theme Four: Barriers to SHCC

Three salient barriers were identified throughout the discourse of the focus groups and are represented as subthemes. These include: (a) Too Expensive for what it is Worth; (b) SHCC can be Hard Work; (c) Poor Range of Garment Options. Identifying the barriers constituted step two of the CBSM process.

Barrier 1: Too Expensive for what it is Worth

Second-hand clothing was cited as becoming increasingly expensive. Consequently, participants expressed that they were unwilling to pay close-to-retail prices for used clothes. However, this did not mean that second-hand clothes were universally viewed as expensive (as reflected in the “Value for Money” sub-theme under “Motivations for SHCC”). “Too Expensive for what it is Worth” aligns with economic deterrents cited in the literature, which corresponds to second-hand clothing being regarded as more expensive than its perceived value, with new clothing often being just as cheap [58,59]. This barrier also relates to second-hand clothing being damaged or poor in quality [58,59,61,62]. As one focus group participant put it: *“I would say the price and sometimes the quality of the garments... really would deter me”*.

Barrier 2: SHCC can be Hard Work

High stock volumes and the time required to sift through numerous items before finding a desirable garment make SHCC hard work. One participant said: *“Well, you know like everyone said like it’s a struggle to find stuff at the op shop for anyone... it’s a much more laboursome process in that you’re sifting through clothes after clothes after clothes...”* This theme reflects the time-consuming nature of second-hand clothing shopping, where much time is spent searching without finding suitable garments. This barrier is consistent with the prominent barrier of poor shopping experiences identified in the extant literature by Laitala and Klepp [59], among others [58,61–63]. Poor shopping experiences encompass the inconvenience of shopping (relating to time consumption), poor store organisation, a lack of online second-hand clothing platforms, and a lack of nearby stores.

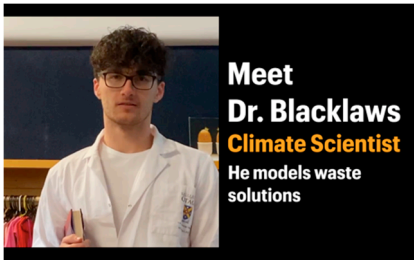


Barrier 3: Poor Range of Garment Options

Participants cited a lack of clothing range as a barrier to finding clothes in second-hand clothing stores. This barrier was increased for plus-sized consumers, who believed that the plus-sized stock was “ugly” and did not suit their style. As one focus group member said: *“I struggle with a lot of it... especially being a slightly bigger woman a lot of the clothes that are my size in op shops are like proper nanny style. . . and I find it really hard because I don’t want to wear that!”* And: *“most of the time three quarters tends to be girls’ clothing which only gives you a couple of minutes of looking through it before you’re finished which can kind of take away from the experience. . .”* Additionally, a lack of range in men’s garments was cited as a barrier for male consumers. This subtheme of “Poor Range of Garment Options” demonstrates the deterrent of a lack of available styles and sizes noted in the literature by Laitala and Klepp [59] and Hur [58] as a trend of unavailability. These papers found that consumers often struggle with the availability of inclusive sizing and unappealing selections. To mitigate the effect of this barrier, there should be more representation of plus-sized clothes and menswear in second-hand clothing stores.

4.2. Video Analysis

A localised present-day context formed the setting for this story [7], while the themes encompassing barriers to and motivations for SHCC formed the story content. Story heroes were chosen based on the literature (scientist) and the focus group findings (influencer and students). The description and rationale for the stories’ heroes are outlined in Table 3. A keyframe analysis of the storyline (following Finkler and León-Anguiano [25]) is given in Table 4.

Table 3. Description and rationale of the three hero characters used in the videos.

Hero Character	Description	Rationale
	Dr. Blacklaws is a climate expert. He is serious about the implications of the climate crisis and believes that action is imperative for securing a sustainable future.	Inspired by “the Gore Narrative” [19], this character is designed as a point of comparison with existing and traditional climate-change heroes.
	@Karas_Kloset emulates a well-known and popular social media influencer. She is cool, attractive, and keeps up with social trends. She is an activist at heart but also uses sustainability narratives to increase her social status.	This character is inspired by findings from the focus groups through the analysis of the theme “Influences of Social Media and Influencers”.
	Kayla and Tina are representations of typical friends or peer figures. They are young and learning about how to be more sustainable through community engagement and trying new things.	These characters were also inspired by the findings from the focus groups and the analysis of the theme “Influence of Friends and Peers”.

It is important to note that the action-based stories only present one solution to the issue of post-consumer textile waste: that is, engage more in second-hand clothing consumption (SHCC).

The development of these stories strives to avoid the cognitive drawbacks associated with traditional science communication approaches. For example, the action-based stories address the concerns of de Vries [8] and Bell et al. [20] regarding information-deficit communication models that illustrate a threat without providing adequate instruction on how to mitigate the risk by suggesting a response behaviour that is perceived as realistic, doable, and meaningful. Furthermore, our action-based stories emphasise acting out a behaviour in preference to overloading on information in an attempt to change beliefs; a criticism levelled at traditional forms of environmental communication, where information alone has proven to be ineffective at evoking purposeful action [6,7,21,22]. In contrast, the inclusion of one simple, local, and specific-to-addressing-the-problem fact fits with the research by Bhattachary et al. [10], Gustafson et al. [24] and de Vries [8], who suggest that traditional science communication approaches tend to overload the audience with complex and impersonal details pertaining to the magnitude and impending threat of issues such as climate change.

Table 4. Keyframe analysis of the action-based storytelling used in the video with a scientist as the hero. Shots #4, #6, and #9 were varied according to the identity of the story’s hero.



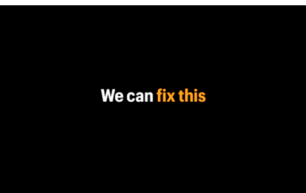
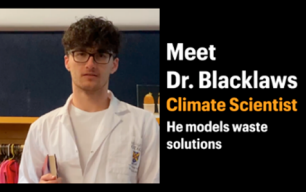
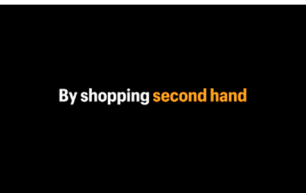



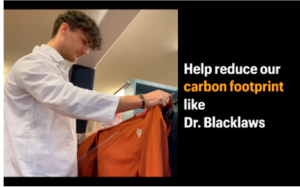


Shot Number	Description	Purpose
Shot #1		Use of “ <i>did you know</i> ” draws audience in. “50% of NZ clothing imports end up in our landfill?” introduces an important, local, concrete issue [7] of post-consumer textile waste ending up in landfill. Use of statistics increases credibility [26]. The problem stated as a question engages the audience, causing them to reflect on whether they were aware of this fact. Additionally, the fast-paced soundtrack with a strong beat is used to subliminally indicate the urgency of the issue and evoke feelings of motivation within participants.
Shot #2		
Shot #3		Shot #3 moves on from the problem and shifts to a hopeful and solution-orientated story tone. Moreover, the colour choice of white and colourful text on a black background is visually striking.
Shot #4		The storyline for each video remains the same in shot 4, with the only differentiating factor being which hero is introduced (as per Table 3).
Shot #5		In line with CBSM, the behaviour of shopping second-hand helps address the issue of reducing post-consumer textile waste. This text also follows on from the hero’s individual introduction and illustrates that the hero is adopting the behaviour of second-hand shopping.

Table 4. Cont.

Shot Number	Description	Purpose
Shot #6	 The story progresses to show the hero demonstrating this behaviour as a concrete action that helps to solve the problem (utilising social modelling, as described by Bandura [27], to evoke agency and self-efficacy within the audience).	This footage evokes positive descriptive social norms [73]. The social modelling facilitates social learning of beneficial behaviours.
Shot #7	 Benefits to the behaviour are accentuated through text. Fast-paced audio; text and text colour change according to the beat.	The benefits of “unique,” “affordable”, and “easy to find” reflect findings from the focus groups (Section 3.1). Additionally, labelling second-hand clothes as “easy to find” evokes self-efficacy within the audience that it is possible to easily find good-quality garments, therefore increasing the ease of the behaviour. “Reduces waste” links to how this solution relates to the problem of post-consumer textile waste. The last statement also reinstates agency in the viewer that their behaviour will positively contribute to mitigating the issue.
Shot #8		
Shot #9	 Split screen, half showing footage of the scientist making the decision to take the coat home, while the text introduces a personalised call to action to mimic their behaviour.	Application of the split screen represents circularity in the character introduction and an exit from the video. This text also reinforces that the solution has a significant environmental benefit. The call to action and footage of the hero walking off-screen drive social modelling and is designed to evoke self-efficacy and agency in the viewer through motivating them to do as the scientist does and to reinforce the idea that this behaviour is easy to do.
Shot #10	 Finally, the video concludes with a clear and concise call to action to shop at the local university-run second-hand store, Te Oraka. Fast-paced audio; text and text colour change according to the beat.	“Shop Te Oraka” directs the audience to take action and shop for second-hand clothes at a specific second-hand store. “Warm yourself, not the planet” is a playful tagline, and this final message of the video alludes to how the behaviour is pro-environmental. These text slates also follow on from the heroes’ individual exits and illustrates that all the heroes are adopting the pro-environmental behaviour of shopping at Te Oraka.
Shot #11	 Screen cuts to black as last notes of the audio ring.	

4.3. Proof-of-Concept Survey and Analysis of Action-Based Storytelling Effectiveness

The survey results indicated that 99% of the 216 participants correctly interpreted the key message of the video. Respondents primarily interpreted the messaging as a call to “shop more sustainably” and “buy second-hand”, and that “SHCC helps reduce textile waste”. However, only 63.4% of participants correctly recalled that 50% of clothing imports end up in landfill. These findings demonstrate that the videos successfully delivered an accurate message; however, the core statistic highlighting the issue was not recalled by over one-third of the respondents. This suggests that participants remember solution-focused

messaging better than an issue-focused statistic, which supports Bell et al.'s contention that asserting issue-focused messaging is “insignificantly robust” [20].

Moreover, when questioned about what they liked most about the video, nearly half the participants (47.2%, 102) cited the simplicity of the message. A further 15.2% (33) liked the fast-paced music best, stating that it kept the video engaging and interesting, making the topic seem important. The next most-liked feature (20.6%; 23) was the solution-focused nature of the story: “*That it gave a solution instead of just telling us the problem.*” When asked to select words to describe the video, most indicated it was *engaging, solution-focused, informative, helpful, motivational, and inspiring*. The video was not deemed to be *boring, confusing, or depressing*. When asked what participants disliked, the most popular answer was “*nothing*” (18.0%, 39). These findings demonstrate the encouraging potential of focusing communication efforts on solutions instead of issues.

4.3.1. Effectiveness of Action-Based Storytelling

As a proof-of-concept study using novel visual research methods, the findings of this paper demonstrate that action-based storytelling is a promising communication approach to connect people with science. This contrasts with a recent review of communication campaigns in the health sciences, which found that most campaigns do not even collect measures that allow them to determine if a campaign objective has been met, with nearly half not even bothering to examine changes in behaviour, knowledge, or social norms [74]. This is symptomatic of a big problem in science communication in general, where, to date, the focus has mostly been on engagement, which is easier to measure, rather than on changes in attitudes and behaviours [75]. However, the results from our study indicate that by using action-based storytelling, this significantly affected the agency and self-efficacy of the participants in relation to shopping for second-hand clothes (Table 5). As such, it provides initial empirical support for the proposal by De Meyer et al. [7] that action-based storytelling should increase agency and self-efficacy to adopt pro-environmental behaviours. There is also a suggestion ($p < 0.1$) from our study that, by watching the videos, such changes in agency and self-efficacy translated into increased intentions by the audience to shop for second-hand clothes (Table 5). Similarly, participants in a study that viewed a video of a man dancing with people all over the world tended to exhibit the increased global identity salience needed to increase intentions to change behaviours relevant to climate change [76].

Table 5. The impact of action-based storytelling on the dependent variables Agency, Self-efficacy, and Intention from before to after viewing the videos. Lower values indicate stronger evidence of Agency, Self-efficacy, and Intention.

Variable	Mean Before	Mean After	Paired <i>t</i> -Test
Agency	1.89	1.84	$t(215) = 1.973, p = 0.05$
Self-efficacy	2.15	1.99	$t(215) = 7.239, p < 0.05$
Intention	1.44	1.39	$t(215) = 1.862, p < 0.10$

The results of our study confirm that action-based storytelling using agency as a story structure can be a productive approach to science communication when integrated into the CBSM model. Moreover, when examining the empirical results alongside the descriptive analysis of the action-based stories, these results highlight (i) the importance of focusing on solutions as opposed to issues, and (ii) that a focus on solutions leads to a greater perception of personal agency and self-efficacy to adopt pro-environmental behaviours. This supports the assertion of Appelgren and Jönsson [77] that framing science communication issues as solutions rather than problems is of great importance for eliciting individual and collective actions.

An increase in self-efficacy after video viewing demonstrates that the video led participants to feel greater confidence in their ability to be part of sustainable solutions and that

their actions have the ability to contribute to reducing clothing waste problems. Participants had a stronger belief after watching the videos that they personally could help to mitigate household clothing waste problems by changing their clothing consumption behaviours.

An increase in agency indicates that participants felt more willing and able to engage in solutions to reduce clothing waste after viewing the videos. The increase in agency also shows that the action-based storytelling evoked a greater sense of personal responsibility to contribute to climate solutions. Finally, participants rated themselves as more likely to shop at a second-hand store in the future, compared with their level of likeliness to do so before viewing the video.

Our findings show that when actions are presented as doable and meaningful, the resulting agency and self-efficacy reinforce and increase the intention of individuals to engage with issues, such as those related to “wicked” problems like climate change [7,38,39]. This is backed up by the findings of Doherty and Webler [40], which show that people who demonstrate high self-efficacy have high intentions of adopting pro-environmental behaviours; this is, in turn, a strong predictor of actually adopting pro-environmental behaviours [41].

4.3.2. The Impact of Different Story Heroes

The impact of different types of story heroes on the levels of agency, self-efficacy, and intention yielded interesting results. While the hero type did not have a significant effect on the agency of participants, perceptions of self-efficacy and intention to engage with SHCC in the audience were both significantly impacted by the type of hero used in the action-based storytelling videos (Table 6). The video with the influencer hero had a significantly stronger effect in promoting self-efficacy and intention than did the video with the scientist hero (Table 6), whereas differences between the influencer hero and student heroes were not significant.

Table 6. Statistical results of the one-way ANOVA with post hoc comparisons measuring the impact of story heroes on dependent variables.

Variable	Hero (Mean)	Hero Comparison (Mean)	Result	Evidence
Agency	-	-	Not Significant	$F(2, 213) = 1.457, p > 0.05$
	Scientist (2.08)	Influencer (1.87)	Significant	$F(2, 213) = 3.512, p < 0.05$
		Students (2.00)	Significant	$p < 0.05$
Self-efficacy	Influencer (1.87)	Students (2.00)	Not Significant	$p > 0.05$
		Students (2.00)	Not Significant	$p > 0.05$
	Scientist (1.56)	Influencer (1.21)	Significant	$F(2, 213) = 6.009, p < 0.05$
		Students (1.38)	Significant	$p < 0.05$
		Students (1.38)	Not Significant	$p > 0.05$
		Students (1.38)	Not Significant	$p > 0.05$

Scientist

Those who viewed the scientist had less-strong levels of self-efficacy and intention after viewing the video compared with the influencer hero. This adds weight to Bushell, Buisson, Workman, and Colley’s contention [6] that scientists or experts are ill-chosen figures to deliver messages encouraging climate-change action. The reason for this could be that a scientist hero is viewed as authoritative and not relatable [20]. Indeed, research shows that scientists need to be authentic as science messengers to overcome their disadvantage relative to influencers, although parts of the population are likely to always prefer influencers [78].

The scientist hero in our video was also a male in comparison with the female heroes used in our other videos. Future research should address the effect that gender may have on the role of heroes in action-based storytelling as well as focusing on more thorough development of the heroes used for messaging. As Gustafson et al. [24] and Hoeken and Sinkeldam [43] point out, heightened character identification drives the persuasiveness and effectiveness of stories.

Influencer

In contrast to the scientist, those who viewed the influencer hero had the strongest levels of self-efficacy and intention after viewing the video. These results reflect the findings from the focus groups thematic analysis, which established that social media and influencers have a high degree of persuasion over where participants shop and what they buy. As identified in the focus groups, social media influencers exert a strong influence and social attraction over this target audience [27]. Furthermore, the influencer was portrayed as of a similar age to the target audience, thus increasing the hero's relatability. These elements of the influencer's characterisation fall in line with Bandura's [27] contention that social modelling is most powerful when the hero character is socially attractive and relatable to the audience's demographics. Indeed, an analysis of YouTube videos by science institutions compared with those by science influencers showed that the latter produced far greater reach and engagement [79]. Science influencers can popularize and amplify science [80]. Recognizing the potential value of influencer heroes, the Max Planck YouTube channel teamed up with influencers and immediately saw substantial increases in views and subscriptions to their channel [81].

The significance of the influencer hero in eliciting self-efficacy and an intention to adopt pro-environmental behaviours could also be attributed to how heroes act as role models and beacons of hope for the audience. The juxtaposition of an influencer shopping second-hand is a potentially optimistic symbol that all hope is not lost for consumers in their efforts to consume sustainably and to reduce impacts on climate change [47]. For example, if an influencer, often associated with conspicuous consumption, can act in favour of the environment, then others are likely to feel inspired to follow suit.

Students

The effect of having contemporary peer-like heroes in the form of students did not have a significantly different effect upon agency, self-efficacy, or intention compared with other hero types. While this offers little support for Bevan et al.'s [49] hypothesis that peers from society have greater persuasive power than experts in delivering pro-environmental messages, this may have been a consequence of the limited sample sizes. Future research could expand the sample sizes, as those used in this proof-of-concept study were necessarily limited and, therefore, had correspondingly limited discriminatory power. On the other hand, our results are consistent with a study that examined the effect of influencers versus peers, which suggests that for peer-like heroes to be effective, they need to be regarded as having expertise, whereas trustworthiness is most important perceived attribute for influencer heroes [82]. The student heroes in our study would be less likely to be perceived as having more expertise than the scientist heroes, whereas influencer heroes just needed to come across as trustworthy.

What is encouraging, given the limitations with our study, is that clear-cut advantages to using action-based storytelling to effect behaviour change were evident, suggesting that this innovative approach has real potential for increasing the effectiveness of science communication.

Eleven of the 78 participants that viewed the video with student heroes identified the student characters as the aspect they liked best about the video, describing them as "relatable" characters. The relatability of the student heroes is likely due to the audience being comprised entirely of students and is aligned with findings from Alison and Goethals [48] who assert that such like-minded heroes fulfil cognitive and emotional needs through providing hope and inspiration.

5. Conclusions, Limitations, and Future Research

This research fulfils the aim of the paper to develop a proof-of-concept study to evaluate the effectiveness of action-based storytelling. It is the first study of its kind to empirically examine the effectiveness of action-based storytelling on agency, self-efficacy, and intention. It is also one of the few to examine the impact of story heroes on such variables. Action-

based storytelling holds considerable potential as a novel form of science communication that can be used to provoke behaviour change in response to problems faced by society, such as those resulting from climate change. The results of this study demonstrate an effective storytelling structure and format that can be used as an exemplar for other situations where communication is needed to connect people with science, and thereby changes to attitudes and behaviour, to effect a solution. However, while this proof-of-concept has been successful, this approach to communication is still in its infancy, and greater development of it should be encouraged. The impact of story heroes is also a potentially rich avenue for research to better understand how heroes can positively influence people's attitudes and actions.

Future researchers may also benefit from utilising alternative advertising and behaviour-change techniques through tailoring video techniques to the audiences' stage in their behaviour-change journey. CBSM offers various behaviour-change tools which may help here. Future research should also compare the results of action-based storytelling with control groups that include other forms of communication. To strengthen the methodology, interviews could also be conducted after the video viewing to understand how and why the action-based storytelling impacted the audience members. Including one-on-one interviews at this stage of the methodology would enable a greater depth of findings for future research to increase the robustness of the findings.

The scope of this research also limits its conclusions. While action-based storytelling has been shown to be effective in the context of SHCC, such findings may not be so robust in other settings. However, the versatility of CBSM and action-based storytelling means that this methodology can be applied in various contexts. More research is needed to examine the effectiveness of action-based storytelling in other settings before making conclusions regarding its holistic effectiveness as a communication tool. Moreover, this study was limited to measuring intentions rather than actual behaviours, and the true effectiveness of action-based storytelling cannot be affirmed without future work that measures its impact on behaviours.

This paper lays the foundation for future research to further investigate the theoretical and practical potential of action-based storytelling and its effect on agency and self-efficacy. This versatile communication approach can be applied to many settings and problems faced by society. It suggests that agency and self-efficacy are important antecedents of behaviour adoption. Additionally, this research supports the future use and persuasive power of social modelling and social media influencers in communications. On a practical level, the novel communication approach of action-based storytelling could be implemented in policy recommendations surrounding public-facing climate-change campaigns. Integrating action-based storytelling and CBSM to policy may also be effective in engaging the public and driving positive change for various social marketing causes. Science communication is not just about connecting people with science; it should also be about empowering them with science. Action-based storytelling is one promising way to do that.

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