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## Risk communication films: Process, product and potential for improving preparedness and behaviour change



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### ABSTRACT

The medium of film is well established for education and communication about hazardous phenomena as it provides engaging ways to directly view hazards and their impacts. Empirical analysis can help to understand films' effectiveness in informing populations at risk and catalysing action to reduce risk.

Using volcanic eruptions as a focus, an evidence-based methodology was devised to create, use, and track the outcomes of digital film tools designed to raise hazard and risk awareness, and develop preparedness efforts. Experiences from two contrasting eruptions were documented, with the secondary purpose of fostering social and cultural memories of eruptions, developed in response to demand from at-risk communities during field-based research. The films were created as a partnership with local volcano monitoring scientists and at-risk populations who, consequently, became the leading focus of the films, thus offering a substantial contrast to other types of hazard communication.

The films were analysed by sharing them with at-risk communities and evaluating the immediate influence on learning and affect. Results indicated that the use of local content and actors to share experiences and teach valuable lessons were inspirational. Recognizable faces and spaces helped to convey disaster risk reduction messages. They also motivated audiences to consider ownership of risk and potential actions to reduce risk and strengthen resilience.

This study demonstrated the effectiveness of co-production in the design and execution of intervention strategies for volcanic risk reduction. Co-production of films with local agencies resulted in products that were contextually appropriate, meaningful for audiences, and useful risk communication tools.

### 1. Introduction

The creation of disaster-resilient communities is partly dependent upon strategies to effectively communicate hazard and risk. In its broadest sense, risk communication should seek to prevent and mitigate harm from hazards by informing people about potential threats, and empowering them to adopt protective measures. Specific initiatives of risk communication will adopt more narrowly defined goals, dependent on the purpose of the communication and the characteristics of the audience [9]. For example, different strategies may be chosen if the primary goal is to raise awareness of specific risks in an emergency

setting, or to enhance understanding of hazardous processes in advance of an emergency; to build trust or to encourage mitigative action [42,6].

It has been established for some time that communication, with the aim of encouraging risk reducing behaviour, will have more success if it is rooted in the socio-cultural context in which the risk is understood [39,7]. Those designing a message must know the context, and use that knowledge to tailor the content to the needs and environment of the social setting. Those delivering a message must be a trusted and credible source. Creating these necessary conditions requires, above all, *time* for interaction between individuals, communities, and institutions that should be involved in discussions around risk. Implicitly risk

**Abbreviations:** ESRC, Economic & Social Research Council; NEMO, National Emergency Management Organisation; NERC, Natural Environment Research Council; SGC, Servicio Geológico Colombiano; STREVA, Strengthening Resilience in Volcanic Areas; SRC, The University of the West Indies Seismic Research Centre; UEA, University of East Anglia

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'messages' should not be one-way. Citizen-centred risk communication processes have been shown, in a variety of contexts, to be important in attracting the public into discourses about issues that may have personal or societal impact [23]. Thus, to support decision making that improves responses to hazardous events, or change attitudes or behaviours, the public need both to participate in discussion around risk, and be exposed to information that is both salient and relevant to them [45].

Participation and information saliency should, in theory, go hand in hand. Contributing to discussion around risk is more likely if the information being shared is both needed and comprehensible. The content of that information is more likely to be context-specific if generated by the very individuals attempting to manage risk. Participation has been seen to be an important motivation for disaster risk reduction by empowering people to act [52] and there is evidence that the *process* of participating is the more effective driver of success than the product or output (e.g., [21]), particularly if the participatory activity is co-produced from the outset with those at risk.

Sharing experiences about previous disasters has been recognised as an important component of participatory risk reduction activities (e.g., [29,28]). Further, retaining the collective socio-cultural experiences of any disaster within communities (and indeed at institutional and government level) has been proved to be an essential component of strengthening capacity to respond to future events [1,12,20,37]. Intergenerational sharing of these collective experiences through narrative, or 'story telling', can be extremely powerful means of communicating in a meaningful and coherent way [54], and has the potential to help build response strategies to potential threats [29,34,36]. Such 'oral histories' are not only an important method of recording, preserving and interpreting narrated memories, but they also act as a participation device; helping to generate a two-way dialogue between the audience and those imparting the message [10]. Oral histories captured on film have the potential to be a powerful risk communication tool [55,61], with the process of film production acting to increase trust and improve relations between those involved in its creation and dissemination, and the product having enhanced saliency for the intended audience. It can allow participants (i.e. the story tellers) more control over what is said, and potentially affords a representation of past events that will more closely resemble the situation for communities at risk.

The application of film (or 'video') as a powerful and effective *hazard education* tool is well documented (e.g., [15,8]). Recognised benefits include the ability to convey information or processes that perhaps are hard to envision or understand, to influence risk perceptions, to increase trust, to motivate behaviour change, and to maintain social memory of particular events [18,56]. However, despite success in other disciplines (e.g., [33]), there is very limited evidence from geophysical hazards research as to the role of film in intervention strategies aimed at *reducing risk* to environmental threats (as an exception see [44,43]).

In this research, we wanted to investigate the use of film as a novel way of engaging with communities around volcanic risk, and analyse our experiment for initial reflections on efficacy and impact. This paper offers a reflection of our learning from the development, application and evaluation of films to communicate volcanic risk in two volcanically active settings. The films are part of a larger effort to integrate and communicate research from the 'Strengthening Resilience in Volcanic Areas' (STREVA<sup>1</sup>) to project partners and communities, with the principal aim of reducing risk to volcanic threats. STREVA is an innovative interdisciplinary project that works collaboratively across different disciplines and aims to reduce the negative consequences of volcanic activity on people and assets. The project addresses the need for innovative approaches to integrate social profiles of risk with

improved understanding of the physical hazard.

The idea to produce risk communication films developed from research and dialogue between STREVA researchers, volcano observatory personnel, emergency managers and at-risk communities in two of the STREVA project's case study countries (St Vincent and Colombia). We used film in both countries as a mass communication vehicle and an attempt to draw in a broad audience: the use of digital media in St Vincent is high, and in Colombia, film could be used to address some of the challenges of engaging with diverse at-risk populations across vast distances. These countries also presented interesting case studies as they have had eruptions within 'living memory' with the threat of possible new ones. However, the eruptions that we document in the films occurred over a generation ago, so this study offered the opportunity to explore the role that film plays in maintaining social memory of eruptions in both St Vincent and Colombia.

In this paper, we show that the films motivated our intended audience to seek new knowledge about volcanic hazard and risk, and empowered many to develop personal preparedness efforts. In both settings, audiences attending the film screenings demonstrated a real sense of connectedness with those sharing their experiences on film, and acknowledged that the memory and learning from these events was important to maintain in society, both for heritage and to strengthen resilience to future eruptions.

## 2. Case study context

St Vincent is the largest island of the country of Saint Vincent and the Grenadines, located in the Caribbean (Fig. 1). The island's only active volcano, La Soufrière, occupies the northernmost-third of the island, and last erupted in 1979. The eruption resulted in the displacement of 20,000 people to safer areas in the south and caused extensive economic disruption. The more explosive eruption in 1902 claimed at least 1500 lives and had severe economic impacts across the Caribbean. Approximately 5–10%<sup>2</sup> of the total population of St Vincent<sup>3</sup> live in the highest hazard zone (red zone; Fig. 1), and are considered at least 10 times more at risk from the impact of eruptions than areas further south [41]. Monitoring of La Soufrière is the responsibility of The University of the West Indies Seismic Research Centre (SRC), a regional agency based in Trinidad, and is organised in collaboration with a locally based Soufriere Monitoring Unit.

Colombia is home to 57<sup>4</sup> volcanoes, 20 of which are actively monitored by the Servicio Geológico Colombiano (SGC), and eight of these have had eruptions within the last century. They are almost all very large stratovolcanoes (> 4000 m), often glacier-capped, and capable of very intense explosive activity. The volcano of Nevado del Ruiz is currently in-eruption (since April 2015 to present day [April 2017]), but its most notorious eruption of 1985 was South America's deadliest recorded, killing 25,000 people from lahars which radiated out from the volcano's summit. Due to the wide geographical extent of the volcanoes (Fig. 2) there are three volcano observatories: Manizales (which monitors Nevado del Ruiz), Pasto and Popayán.

## 3. Aims and approaches

### 3.1. Concept

The initiative to use film as a strategy for volcanic risk communication, and ultimately, risk reduction, was a product of extensive consultation with STREVA in-country project partners and comprehensive research in our case study regions. We did not make assumptions

<sup>2</sup> It is difficult to derive the exact value since the 2012 Census does not provide the subdivision amongst communities.

<sup>3</sup> Population of 109,911 as of 2012.

<sup>4</sup> Information from the Global Volcanism Program of the Smithsonian Institution <http://volcano.si.edu/>.

<sup>1</sup> [www.streva.ac.uk](http://www.streva.ac.uk).



Fig. 1. Map of St Vincent showing main road, water courses and volcanic hazard zones (inset showing position in broader Caribbean location). (For interpretation of the references to colour in this figure, the reader is referred to the web version of this article.)  
Map adapted from [32].

that film would be a successful tool for risk communication in these contexts; we treated it as an experiment to identify what elements of both the product (i.e. the film) and the process of making and screening the films contributed to improved knowledge and risk reducing behaviour change.

Our approach to developing the films was very much in keeping with the overall approach of the STREVA project: interdisciplinary and collaborative. Our extensive research across physical and social sciences in our chosen settings informed the way we, and our project partners, co-designed the film aims, selected the intended audience and drafted the narrative thread. This underpinning data included: (i) historical analyses of previous eruptions in St Vincent [40]; (ii) group discussion data from earlier STREVA ‘forensic’<sup>5</sup> workshops held in St Vincent and Colombia in 2014 [26,5]; (iii) interview data with project partners and communities [3,4,58], and (iv) learning from other

<sup>5</sup> An interdisciplinary, retrospective approach to determine causality of disasters by understanding both the underlying drivers of the physical processes that trigger the disaster and their evolving impacts and dynamic interaction with pre-existing social and physical vulnerabilities. STREVA’s forensic workshops were conducted in St Vincent and Colombia to understand the dynamics of different phases of eruptions, their impacts and evolving preparatory actions to volcanic hazards and risk over time.

volcanic settings (e.g. Montserrat and Ecuador) [19,25,27,5,52,57]. The breadth and depth of data, as well as our strong relationships with communities in both settings, was essential to position the films within each specific socio-cultural context and to ensure the aims of the films were both relevant to, and met the needs of the audience.

### 3.2. Design

Our aims for both sets of films were largely the same, although tailored to the country context, audience, and the communication strategies of both monitoring agencies with whom we were working (SRC and SGC). Our learning from the process of making the films in St Vincent guided our choice to afford equal importance to the *process* of filmmaking in Colombia as to the *product* (Fig. 3). Both sets of films aim to: a) raise volcanic hazard and risk awareness; b) foster social and cultural memory of eruptions; c) empower communities to develop preparedness efforts, and d) strengthen local-to-national lines of communication around risk and response. Table 1 shows a summary of the aims, outputs and outcomes of the films.

To achieve these aims, we made specific film design choices. Firstly, we wanted to produce oral history films that were entirely led by local



Fig. 2. Shaded relief map of Nevado del Ruiz and surrounding towns, villages and major river channels (inset showing all volcanoes in Colombia). Towns where we conducted screenings and workshops are in bold italics. World Shaded Relief Map - ESRI; volcano locations – Global Volcanism Program [22]; river locations [38]; town locations – Servicio Geológico Colombiano [47].



Fig. 3. Photo from film screening and workshop in Fancy, St Vincent. Photo © Lara Mani.

actors<sup>6</sup> telling their stories. The purpose of this was to make the films context-specific, relevant to the audience, to give a voice to communities, and to encourage the preservation of social memory of eruptions. Secondly, we wanted to maximise impact by creating content that triggered attention, achieved comprehension and generated an emotional response which would positively influence decision-making around risk [10]. This meant we purposely avoided including new or archival footage which was potentially upsetting (including actual footage of volcanic phenomenon ‘in-action’). While some evidence suggests fear-based stories or appeals may be useful to persuade behaviour change around certain health risks [60], for other risks this approach has the potential to demotivate, generate fatalistic thoughts, or even inadvertently trigger maladaptive behaviour [44,59,60]. Ethical considerations such as this were discussed and built into the design at the outset, and reassessed throughout the lifecycle of the project.

We also wanted to keep the films short. As the primary sharing platform for our St Vincent films was YouTube (plus other social

media), it was important to keep the narrative concise and entertaining in order to maintain audience attention. Our decision to make a trilogy of films for each setting was related to the established aims (Table 1). The first film in each of the trilogies aimed to maintain the social memory of eruptions by sharing people’s experiences; the second film focuses more on the days and weeks that followed the eruption(s), aiming to highlight the diligence required to recover and rebuild livelihoods and communities following a disaster, and the final film situates the audience in the present, taking a look at the volcanic hazard and risk today and what life is like for communities living alongside volcanic risk. There were subtle differences between the final film for the St Vincent and Colombian audiences. In Colombia, we chose to focus more on preparing for the next large eruption rather than improving hazard awareness. On St Vincent, we focused more on hazard and risk awareness and produced 6 very short (1–2 min) films tailored to particular problems or topics that had been identified through previous research and community engagement [14,3].

The final component of the design stage was to prepare the questions and identify interviewees (our local actors) to appear on film. Questions were guided by the aims of the films and informed by our research within the STREVA project. Interviewees were usually known from previous interaction through research activities. Whether they were people that we had surveyed in the past, or had just become acquainted with during our research, they were people we knew, who knew and trusted us, and were willing to share their experiences on film. These experiences were often very emotional for both the interviewee to convey and for the researcher to witness, so strong relationships between the two (at least) were essential to develop the interpersonal trust necessary to bear the weight of the disclosure. Perhaps most importantly, interviewees were also selected to ensure our films were representative of affected communities, social hierarchies, age and gender. We wanted audiences to be able to see people on film that they, at the very least could identify with, if not know or had routinely interacted with. Character identification is one of the pivotal mechanisms for generating emotion in film [49], itself known to affect risk perceptions and preparedness intentions [53]. At times, we also interviewed community leaders (i.e. respected members of the commu-

<sup>6</sup> Ordinary citizens, rather than film actors.

**Table 1**  
An overview of the two sets of films.

Country-Volcano-Eruption	Film aims (s)	Project partners	Target audience	Outputs		Outcomes	
				Product (s)	Film screenings and evaluation	Process (immediate impact)	Long-term impacts
St Vincent	(i) motivate and empower people at risk to prepare for eruptions; (ii) increase awareness of volcanic hazard and risk; (iii) sustain social memory of the 1979 eruption.	The University of the West Indies Seismic Research Centre (SRC) National Emergency Management Organisation (NEMO)	Individuals at risk from future volcanic activity of La Soufrière volcano	3 × short 'oral history' films 7 × short risk communication films Qualitative and quantitative data from evaluation	7 × film screenings in communities in the high volcanic hazard 'red' zone	Knowledge sharing over wide area (films broadcast nationally); raising awareness of volcanic hazard and risk; creating a dialogue around evacuation, alerts, and preparation	Films part of SRC's and NEMO's communication strategy.
Colombia Nevado del Ruiz 1985	(i) commemorate the 30-year anniversary of the eruption of Nevado del Ruiz; (ii) raise awareness of the hazard and risk posed by the volcano; (iii) sustain social memory of the 1985 eruption; (iv) support communication links between SGC and the public.	Servicio Geológico Colombiano (SGC) University of Manizales School of Psychology	General public	3 × short films (1985 eruption); recovery and livelihoods today; hazard and risk communication Qualitative and quantitative data from evaluation	4 × film screenings in communities affected by the eruption	Giving communities a voice, empowering them to act to reduce their risk by creating a dialogue around preparation; knowledge sharing; raising awareness of volcanic hazard and risk.	Films part of SGC's communication strategy

nity) and occasionally authority figures, to give local legitimacy and source credibility and to help support and promote the aims of the films (e.g., [13,35,16]).

### 3.3. Filming

Detailed planning and preparation meant that filming in each location could be completed in a week (St Vincent – February 2014; Colombia – September 2015; Fig. 3). The in-country production team consisted of a camera, sound, and lighting operator from Lambda Films, and at least one researcher acting as a producer/director. Interviewees also acted as co-producers, sharing their opinions about where to film their interviews and what they wanted to show or discuss. Volcano monitoring agency directors were also present as both co-producers and interviewees.

Establishing a strong relationship between all team members was vital in order to realise and communicate each other's roles and expectations. Where possible, we also worked to establish a pre-existing relationship between the interviewee and researcher in order to build trust and manage expectations. Cut-away shots were filmed at the scene of the interview, but also around the volcano and surrounding areas (also known as 'general views'). Not only are these shots necessary to assemble film sequences, but we also found that the images acted as a powerful communication tool in of themselves.

### 3.4. Post-production

Editing and narrative sequencing was a highly iterative, collaborative activity and undoubtedly the most time-intensive component of the process (Fig. 3). This was for a number of reasons, as follows: 1) trying to achieve an effective combination of message, narrative and aesthetics; 2) showing respect to our interviewees (i.e. ensuring each interviewee appears at least once) versus keeping the films concise; 3) getting the music balanced against the visuals to elicit an emotional response [49]; 4) editing in a non-native language (for Colombia); 5) balancing the aims of our films with the range of topics interviewees wanted to talk about, and, 6) editing the films down to an appropriately short length (a few minutes) in order to retain viewers' attention (St Vincent: *Film 1* [5:59]; *Film 2* [7:04]; *Film 3* [6:34]; *St Vincent Risk Communication shorts* [average 2:33]; Colombia: *Film 1* [7:37]; *Film 2* [8:17]; *Film 3* [9:29]).

### 3.5. Dissemination

We disseminated our films via a number of channels. In both settings, we organised local film screenings (and associated tailored workshops) and held them at central public venues in several at-risk communities. This was purposely designed to maximise the number of attendees and attract people that may not normally engage with hazard and risk-related discussion. Around 200 participants attended local film screenings in at-risk areas around La Soufrière, St Vincent (Fig. 4), and over 700 people attended screenings around Nevado del Ruiz (Fig. 5). In St Vincent, screenings and workshops were organised in Fancy, Owia, Sandy Bay, Overland, Georgetown, Chateaubelair and Troumaca (high-medium volcanic hazard zones; see Fig. 1) and in Colombia in Nuevo Rio Claro, La Nueva Primavera, Armero-Guayabal and Lérica (Fig. 2). Conducting and advertising multiple screenings was very time-intensive (Fig. 3), so we used community gatekeepers to support this process. In St Vincent, advertising was facilitated by members of the community-based district disaster committee with whom we had strong relationships, and in Colombia, advertising and the facilitation of group discussions at the screenings was supported by researchers at the Psychology department of the University of Manizales, with whom STREVA had co-produced research.

Copies of the films were also given on memory sticks to all attendees at the St Vincent screenings, and were broadcast nationally in St

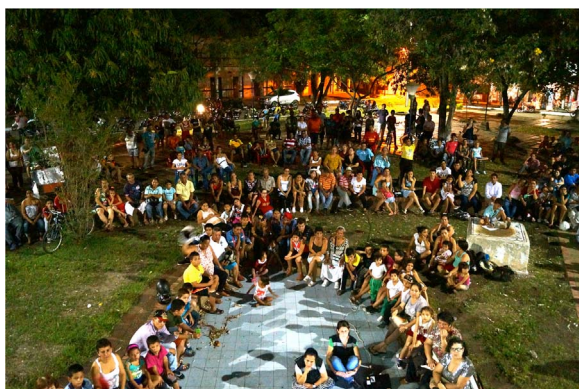


Fig. 4. Photo from film screening in Lérída, Colombia. Photo © James Hickey.

Vincent. In both settings, the films were shared via social media outlets of the monitoring agencies for which the films were made.

### 3.6. Evaluation

To understand the extent to which the films moved beyond their aims, we used several methodologies. In both settings, we conducted pre- and post-screening surveys with attendees, group discussions, participant observation, and analysed data from online analytics (Tables 2 and 3). Pre- and post-screening surveys were conducted with all attendees at the St Vincent workshops, but only a representative sample of attendees (30–45%) were surveyed in Nuevo Río Claro and La Nueva Primavera (Table 3). This was both because the Colombian groups were too large to complete a 100% survey, and due to the sensitive nature of the films necessitating longer discussion in smaller groups. No surveys were conducted in Armero-Guayabal and Lérída as the groups were too large.

Surveys included both open and closed questions. Before the films were shown, survey respondents were asked questions about their motivations for attending the film screening, and their perceptions of the risk and impact from volcanic hazards. Following the films, a second survey explored adjustments in attitudes and beliefs about the volcano, and any triggers of change in behaviour as a result of watching the films. It was necessary to adapt the survey design between screenings in each community, not only because some questions had to be tailored to different community contexts and literacy levels, but also

Table 2  
Online analytics (Nov 2014–Nov 2016) of the St Vincent ‘Eruption Stories’ film trilogy (adapted from YouTube data).

Online views			
Film 1: Eruption	10,389		
Film 2: Response and recovery	4954		
Film 3: Living with the volcano	4623		
Audience demographics of film 1			
Viewer age	Views	Male (58%)	Female (42%)
13–17 years	4%	57%	43%
18–24 years	15%	56%	44%
25–34 years	32%	52%	48%
35–44 years	18%	57%	43%
45–54 years	16%	63%	37%
55–64 years	8%	66%	34%
65+ years	6.8%	70%	30%
Top five playback locations of film 1			
Country	Views	Average % viewed	
St Vincent & Grenadines	2246 (25%)	64%	
United States	2431 (25%)	58%	
United Kingdom	1541 (13%)	49%	
Canada	1074 (11%)	59%	
Barbados	532 (5.1%)	65%	
Devices used to watch film 1			
Device type	Views	Average % viewed	
Computer	5179 (50%)	53%	
Mobile phone	3572 (34%)	55%	
Tablet	1344 (13%)	56%	
TV	228 (2.2%)	75%	
Game console	31 (0.3%)	69%	
Unknown	35 (0.3%)	55%	

our learning from one screening to the next required us to slightly modify language to improve comprehension (Table 3). Responses to open questions in surveys were coded according to themes that were selected for their consistency across the two communities.

In Colombia, we also wanted to explore the type and variation of emotional responses to each of the three films. So, in group discussions conducted between each film, we simply asked, “How did it make you feel?” Responses from these group discussions were coded against a set of emotional and behavioural response themes that were selected for their consistency across the discussions.

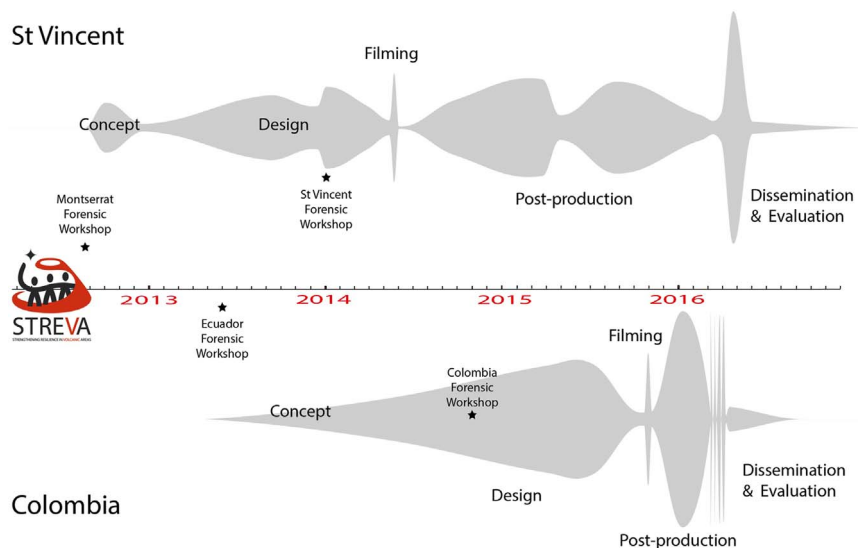


Fig. 5. Timeline of film production process in each setting. Lens width shows actual time spent on each process element. Lens height shows relative effort required for each process element. This diagram presents evidence of transfer of learning from one project to another in order to develop ‘shortcuts’. However, despite timesaving method adjustments between projects, extensive time was still required for post-production.

**Table 3**  
Film evaluation methodology.

Colombia	Date	#Attendees	#Surveyed	Pre/post written survey (learning)	Group discussion (learning)	Group discussion (affect)	Comments, learning and iteration of method
1	Nuevo Rio Claro 07/03/ 16	~125	42 <sup>a</sup>	Both	N	Y	Strength of group discussion, particularly around emotional response, becomes very apparent.
2	La Nueva Primavera 08/03/ 16	~150	41 <sup>a</sup>	Both	N	Y	Strength of question, "How did it make you feel?" recognised.
3	Armero-Guayabal 10/03/ 16	~250	None (only group discussions)	Neither	Y	Y	Attendance is too large to give out written surveys. Smaller sub-groups asked only about what information surprised them from the film and how did it make them feel.
4	Lérida 11/03/ 16	~150	None (only group discussions)	Neither	Y	Y	Attendance is too large to give out written surveys. Same approach taken as per Armero-Guayabal
<b>St Vincent</b>							
1	Fancy 11/04/ 16	30	100%	Both	Y	N	Most important information from pre-film survey around current preparedness measures and previous attendance at similar workshops. Varying literacy levels caused some problems.
2	Owia 12/04/ 16	34	100%	Both	Y	N	Addition of name and age to survey. Again, varying literacy levels caused some problems. Some people felt like they were taking a test.
3	Sandy Bay 13/04/ 16	53	100%	Both	-	N	Attendee number too large to split into smaller groups so discussion of response to the films was conducted in plenary
4	Overland/Orange Hill 14/04/ 16	13	100%	Post	Y	N	Decision to combine key questions from prefilm to postfilm survey and reflect on learning from group discussions instead.
5	Georgetown 18/04/ 16	26	100%	Post	Y	N	No further iteration
6	Chateaubelair 20/04/ 16	17	100%	Post	Y	N	No further iteration
7	Troumaca 21/04/ 16	33	100%	Post	Y	N	No further iteration

<sup>a</sup> These are averages as variable numbers of respondents completed all questions. Actual numbers of respondents per question are stated in the appropriate figure caption.

**Box 1**

Reflections on the films and film making process from the Seismic Research Centre at the University of the West Indies.

The 1979 eruption of the La Soufriere volcano was, in the minds of most Vincentians, a significant event in the history of St. Vincent and the Grenadines. Yet, in the scramble to cope with and manage the crisis there was - and still is - very little film and video documentation about this eruption. Some of this may be due to the fact that the available technology at the time did not readily facilitate the capturing of video footage, but some if it is simply due to a lack of effort and opportunity. It was, therefore, not surprising that one of the main requests coming from participants in an earlier STREVA workshop in 2014 would be that there was a need to document this most important event. Given that the eruption had by then been experienced over 30 years ago, attempting to document peoples' experiences was expected to pose major challenges. However, a decision was made to develop the project with the full participation of the National Emergency Management Organisation and the Seismic Research Centre; the two key agencies involved in raising awareness and educating the public about volcanic hazards in St. Vincent and the Grenadines. The participatory process used to complete the films was a key element in their eventual success. In seeking to work very closely with NEMO and SRC, the film-making team enabled access to spaces within the communities affected by the 1979 eruption, which would not have otherwise been possible. They were able to reach out to prominent community members who had experienced the events and who were able to creatively describe their experiences. This resulted in an amazing communication of experiences and, arguably, was as close to a collective retelling of the story as ever there could be. The oral history films have transformed the 1979 eruption from a distributed memory amongst the individual community members into a common story that has appeal to a wide Vincentian audience - even those who never experienced the events. The films are truly wonderful examples of communities creating their own version of their history.

The participatory process involved in the film project enabled the local and regional agencies to ensure that key hazard messages were addressed in the hazard films that went along with the recording of the 1979 eruption experience. Volcano hazard awareness campaigns undertaken in the past had shown that vulnerable communities on the flanks of the volcano had developed several persistent, and potentially harmful, misconceptions over the years. The hazard films provided an opportunity to specifically address these while also enabling Vincentians a chance to tell their story of the eruption. The beautiful imagery captured on film, and stunning images of the volcano, presented the hazard in a way that enables the local audience to be proud of their natural heritage as well as be respectfully aware of the dangers it poses. The reactions from local audiences indicate that these films will provide a lasting testimony to the experiences of the 1979 eruption, as well as a useful tool for use in future education and awareness campaigns staged by NEMO and SRC.

If the project had ended with just the production of the films it would have been a very worthwhile activity, and one that addressed a need identified by the local community. However, the decision to arrange several community-based 'screenings' of the films helped to further cement their current and potential impact. It was clear that in viewing members of their own community on films, in familiar places, and talking about an event that had great impact, the audiences were emotionally affected in a positive way, and their awareness, and willingness to take action to mitigate the impact, of future eruptions may have been enhanced. The community workshops also enabled NEMO and SRC officials who attended to respond to, and provide direct and immediate clarification on, issues raised. The involvement of these agencies at the workshops also helped to legitimize the entire exercise, and we believe would have encouraged greater participation in the feedback provided about the films.

The oral history and hazard films have become a useful and potentially very effective tool that will be used by NEMO and the SRC in their annual volcano awareness exercises. The experience has shown both agencies the utility and potential effectiveness of this medium, and they are both now committed to exploring other available options for using this medium in future risk communication. The conceptualization of the film project (responding to identified needs of the communities), the participatory process of its execution, and the final product are, together, a very positive example of how the process of engagement in community disaster risk reduction can and should be affected.

#### 4. Process and product to empower risk reduction

The remainder of this paper reports the findings from the surveys and group discussions in each setting. It presents a selection of analyses framed around the films' aims, broader discussions across the film production process(es) and the product(s), and their role in empowering people to act to reduce risk. Results are integrated into discussion, where relevant, and are presented in three subsections. Also included are reflections on the films and the film-making process from our project partner monitoring agencies, SRC and SGC (see [Boxes 1 and 2](#)).

##### 4.1. Films as motivation for people to actively seek information

One of the aims of our films was to *raise awareness of volcanic hazard and risk*; not just among groups and individuals who have a tendency to engage with new information in this field, but also for a broader network of people who may not usually want, or be able, to access information. Informed by recent research in both settings [3,4,58], we ensured that the film content, and the methods of dissemination (e.g. workshops, online) addressed the needs of a broad potential audience.

##### 4.1.1. Previous engagement and motivation

In St Vincent over half of all workshop attendees had never attended an event related to volcano information ([Fig. 6](#)). The workshop in Sandy Bay had the highest number of attendees (70% of 53 people) that had either not been willing, or able, to engage with volcano-related learning opportunities in the past, whereas our workshop in Fancy had the lowest number (32% of 30 people) of 'new engagers'. Despite both areas being in the high hazard zone ([Fig. 1](#)), and having both been severely affected in previous eruptions, this disparity could be a function of: a) a disproportionate focus of volcano-education activities previously being directed towards the community of Fancy; or b) a deliberate focus of engagement activities towards students of primary and secondary school age in schools in high hazard areas (and not the general public); and/or c) the mobilization efforts of the local disaster committees (National Emergency Management Organisation [NEMO] or Red Cross) who have varying levels of functionality and effectiveness in the different communities.

Comparing results from two Colombian communities located around the Rio Claro (~4 km distance apart; [Fig. 2](#)), about 70% of the surveyed attendees that answered this question (41 people) in Nuevo Rio Claro *had attended* a hazard-related engagement event before, but nearly 50% of the La Nueva Primavera group that answered

**Box 2**

Reflections on the films and film making process from the Servicio Geológico Colombiano (translated from Spanish).

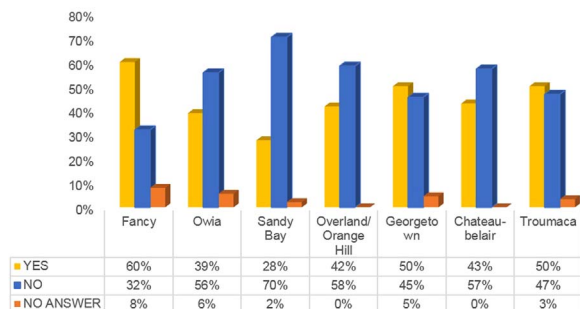
After the forensic workshops conducted at the beginning of STREVA's research in Colombia (in 2014), we observed that many of the survivors, or those affected by the eruption of the 13th of November 1985, had the need and willingness to tell their stories as an act of catharsis. As the 30th anniversary of the eruption approached, the communities began to show interest in contributing towards preserving history. As many of the main actors in the events that took place 30 years ago pass away, their stories are also dying.

The films were not part of the initial plans for the research project but after the initial workshops an important question was raised: "What will be left for the communities after the research workshops?" As a result, the films generated a positive reaction, acceptance and also a sense of curiosity for people to see their neighbours on film. The narratives that people shared are personal stories, but the way they are told had the ability to touch many people. Beyond the usual sensationalist journalism that took place at the time, there is little archival material available that provides a record of people's experiences; it still remains necessary to weave collective memories.

There is some incomplete and scattered information from before, during and after the eruption. Colombia does not have a documentary for Colombia, and the world, that integrates all these elements as these three videos summarise it. I believe that the lesson for us as a country remains the possibility to explore the viability to have more transdisciplinary projects to encourage people to actively participate and tell their stories, to transmit messages of prevention that can transcend history. In the future, it would be good to support and encourage communities to make their own 'home made' films, and for them to choose the most representatives stories for each location. In addition, these films (and other communication products) could be the basis for a future multi-platform media project (e.g. online, film, and written).

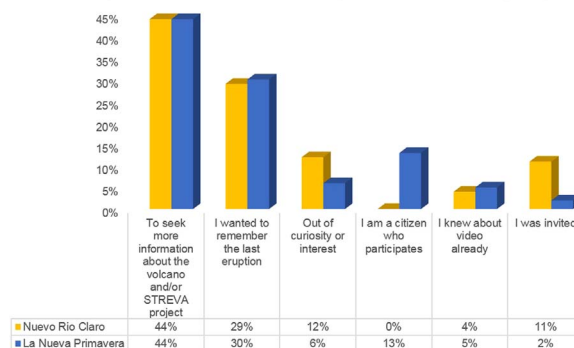
A positive contribution would be to take advantage of these films to share with people and to provide clarity regarding the function and competency of each of the institutions involved in managing volcanic risk. It would also contribute towards the positioning of these institutions amongst the communities, so that they gain trust and credibility and, when nature (the volcano) tests us, recommendations are taken seriously and decisions are made that can save lives.

Pre-film question in St Vincent: Have you ever attended an event related to volcano information?



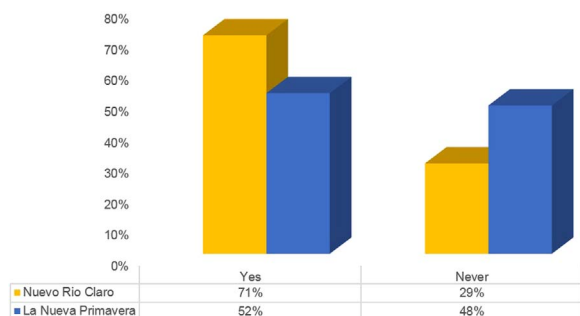
**Fig. 6.** Responses to a closed pre-film question asked of St Vincent audiences. The question was, "Have you ever attended an event related to volcano information?" Results show the geographic variance in responses and the strong spatial relationships with the hazard and how it affects that response. Actual number of surveyed attendees in each location are as follows: Fancy #30; Owia #34; Sandy Bay #53; Overland/Orange Hill #13; Georgetown #26; Chateaubelair #17; Troumaca #33.

Pre-film question in Colombia: What motivated you to come to the screening today?



**Fig. 8.** Responses to an open pre-film question asked of audiences in Nuevo Rio Claro and La Nueva Primavera, Colombia. The question was, "What motivated you to come to the screening today?" Responses to open questions in surveys were coded according to the six themes presented in this figure. Actual number of surveyed attendees who answered this question in each location are as follows: Nuevo Rio Claro #41 and La Nueva Primavera #42.

Pre-film question in Colombia: Have you ever attended an event related to natural hazards information?



**Fig. 7.** Responses to a closed pre-film question asked of audiences in Nuevo Rio Claro and La Nueva Primavera, Colombia. The question was, "Have you ever attended an event related to natural hazards information?" Actual number of surveyed attendees who answered this question in each location are as follows: Nuevo Rio Claro #41 and La Nueva Primavera #42.

this question (42 people) had never attended such an event (Fig. 7). Despite this apparent lack of engagement with, or availability of, volcano-related information, people in both villages were very aware both of the potential for a future eruption within their lifetimes and the extent of the impact. When we asked people what their main motivation was to attend the screenings, nearly half of respondents in both Nuevo Rio Claro and La Nueva Primavera said it was to seek more information about the volcano (Fig. 8).

The high percentage of 'new engagers'<sup>7</sup>, and their desire to actively seek more information, suggests that our community-based approach to film screenings and tailored workshops encouraged people to attend. The practical reason for this may simply be that many of these at-risk communities are geographically distant from more densely populated towns and cities, particularly for the case of St. Vincent [17], and

<sup>7</sup> All screening attendees, 'new', or otherwise, to engaging with volcano-related learning opportunities, were all residents of the local communities in which the screenings took place, (with the exception of Troumaca in St Vincent where Red Cross representatives were also present). There were no non-locals or tourists present at the screenings.

physically getting to populated areas, where volcano related activities are more common, can be expensive. Further, evidence from the STREVA project demonstrates that making repeat visits to communities showed commitment of the researchers, developed reciprocity, and helped to build trust and partnerships [3,4]. These are conditions that affect judgements about risk [48] and help mobilise individuals and communities to act, if only to seek information (e.g., [46]). The format of the communication was also important, as people were keen to watch a film, and we could also suggest that the ‘exclusivity’ afforded by holding tailored community-based screenings and workshops improved attendance and heightened interest.

Data from online analytics also helped to understand demographics and playback locations of audiences viewing the films through YouTube and other social media. The data gave insight into viewing duration and devices used to stream the films (Table 2), which was particularly useful for analysing the St Vincent audience, for which our main dissemination avenue was online. Reflecting on our aim to use the films to maintain social memory of eruptions in St Vincent, these data showed that over 53% of people viewing the films were born after the most recent eruption (in 1979; our ‘target’ age group [ $< 35$  years]), and the highest number of views were from St Vincent itself. Audiences from the island also had one of the highest viewing retention rates (65%; see Table 2).

#### 4.1.2. The role of the films in changing understanding

In both settings, we wanted to use a survey to quantitatively test if the films triggered a change in understanding, although this alone offered just a snapshot reaction to the films and a relatively primitive analysis of any learning. Without a repeat survey it is not possible to measure whether that information is either retained or used. Therefore, initially we shared some of the results from the survey and then later, by integrating this with the qualitative data from the group discussions, we were able to reflect on what people ‘took home’ from the films.

In St Vincent, the survey conducted after the film screening showed that 68% of attendees across communities felt that the films changed their understanding of the volcano. When asked, “In what ways had their understanding changed?”, the majority of these individuals reported new knowledge about the hazards associated with volcanic activity, particularly around the speed of pyroclastic flows and the need for early evacuation from towns north of the dry Rabacca river on the windward side of the island (Fig. 1):

*“That the risk in Fancy is not so much directly from the volcano, but getting trapped here.”*

Resident of Fancy, April 2016

*“Most importantly, the speed at which the flow can get to the Rabacca river and cut us off if we do not adhere to the early evacuation process.”*

Resident of Sandy Bay, April 2016

Our St Vincent films also aimed to dispel many of the local myths associated with the volcano and, as a result of watching the short risk communications films (Table 1), many individuals acknowledged that: a) the lava dome of La Soufrière was not growing; b) that the occasional smell of sulphur was related to a change in wind direction rather than increased emissions, and c) plant growth in the crater showed stability of the area:

*“That not every time that you smell sulphur does it mean that the volcano is erupting. Because the sulphur smell is always there.”*

Resident of Fancy, April 2016

In Colombia, in response to a question posed [either as part of a group discussion (Lérida and Armero-Guayabal), or as an open survey answer (La Nueva Primavera and Nuevo Rio Claro); Table 3] about the way in which their understanding of volcanic activity had changed, many individuals suggested either that they understood more about the volcano’s behaviour (21% of a total of 162 respondents), the events of 1985 (21%), or indicated they recognised the need for some new form

of preparedness for the next event (41%). In response to the question, “Did any particular information in the films come as a surprise to you?”, the majority of people said it was the range, nature and extent of the impacts that were the most surprising:

*“The videos surprised me because I did not know that the volcano had done so much damage and affected the inhabitants of the areas close to Nevado del Ruiz”*

Resident of Nuevo Rio Claro, March 2016

An unexpected finding from asking this question was that many people were surprised at the resilience of the population (30% of the people surveyed in La Nueva Primavera):

*“I was surprised by the effort and faith with which survivors recovered despite all the needs they had after the disaster”*

Resident of Nuevo Rio Claro, March 2016

We reflected further about the relationship between identifying resilient characteristics and the generation of feelings of optimism later in the discussion (Section 4.3).

These statistics suggest that the films did modify understanding about volcanic hazard and risk in both settings. Learning was, for the most part, triggered by the oral history films. This also addressed our second aim of the films, to *foster social and cultural memory of eruptions*. Oral histories not only presented an opportunity for an individual to share an experience from their past, but also offered an audience an opportunity to observe and reflect on those experiences, creating an experiential learning encounter for themselves:

*“This is a good way of opening our eyes to alert us and improve. We must be conscious that it is possible to lose our material possessions, our lives and that of others.”*

Resident of Armero Guayabal, March 2016

*“The experiences of the interviewees would be a guide for me, so in other words I am learning from their experiences.”*

Resident of Georgetown, April 2016

*“I would share this video with others so that they know about the volcano and learn from those that had the experience of an eruption”*

Resident of La Nueva Primavera, March 2016

Beyond using the films to help audiences actively seek information, the *process* of making and disseminating the films also allowed people to actively *share* information. Despite a generation passing since the disasters recorded in the oral history films, people still felt a desire and need to talk about their experiences and, perhaps surprisingly, reported that they had little opportunity to voice their opinions or feelings previously. By co-producing the films *with* the communities, the films themselves became a product of shared knowledge for the communities. This process enabled those involved to develop a higher level of understanding around volcanic hazard and risk (e.g., [45]).

#### 4.2. Films to empower people to direct knowledge into action

Part of the initiative to use film as a vehicle for volcanic hazard and risk communication resulted from an appeal from community representatives attending STREVA workshops. While these earlier workshops offered attendees an opportunity to participate in scenario exercises and to imitate their responses to plausible eruptions [24], an identified problem from these exercises was that many participants would still wait to hear (mostly from authorities) before acting (for example, to evacuate). In these exercises, participants realised that waiting to observe something happening at the volcano may delay potentially life-saving action. As a result, there was a request for us to share this learning more widely, and in a format that motivated communities to use new knowledge to inform independent decision-making.

This second discussion section presents data addressing the third aim of the films: to *empower communities to develop preparedness efforts*.

4.2.1. The role of the films in empowering people to act

In St Vincent, across surveyed communities, about 50% felt that the oral history and risk communication films had encouraged them to evacuate early in the event of an eruption of La Soufrière. Evidence shows that people in St Vincent have good knowledge of evacuation routes, but identified a need for household, and school, preparedness plans [3]. Following the screenings of the films, each attendee (~200 people) collected a blank ‘Household Emergency Plan’ template for them to complete with their families, and we held further tailored workshops with school teachers across St Vincent:

*“[Now I will] be looking for information about the activity taking place on the volcano and to have a definite plan in place if evacuation is necessary”*

Resident of Owia, April 2016

In Colombia, the majority of those surveyed would share the films with their friends or family, mostly to inform, but also to help preserve the memory of the eruption and to support preparedness efforts. People said they were encouraged to be more prepared, listen for alerts, and move to higher ground in the event of an eruption (Fig. 9):

*“In case of an eruption I would go far away from the rivers and follow the instructions given by authorities”*

Resident of Nuevo Rio Claro, March 2016

*“We must be prepared and seek information to prevent another tragedy from happening”*

Resident of Nuevo Rio Claro, March 2016

4.2.2. The role of the emotion in empowering people to act

While filming interviews in Colombia, we were sensitised to the strength of the highly emotive experiences that our interviewees shared. Therefore, at the community screenings, we also wanted to explore the type and variation of emotional responses to each of the three films; to draw on those emotions to engage in discussion around volcanic risk, and to understand what, if any, of those emotions triggered a behaviour change.

We discovered that each of the three films invoked a range of emotional responses within and across the communities. The dominant emotion in response to film 1 was sadness; after watching film 2 the majority of the audiences felt optimistic, and film 3 invoked feelings of being supported by institutions tasked with volcano monitoring and emergency response (Fig. 10). However, there were some variations in affect between communities. In Armero-Guayabal, 33% of those that contributed to group discussion (~24 people) said that film 1 brought

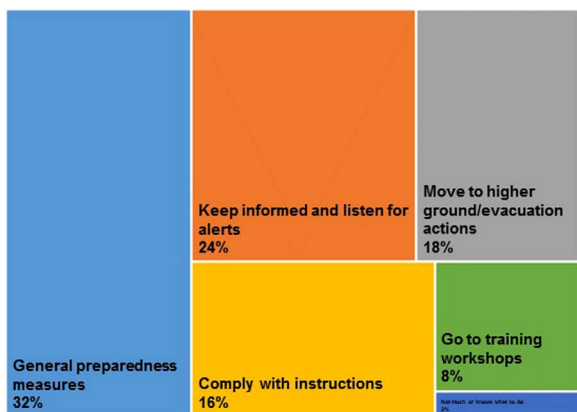


Fig. 9. Responses to an open post-film question asked of audiences in Nuevo Rio Claro and La Nueva Primavera, Colombia. The open question was, “What sort of actions might you now take to reduce your risk to eruptions?” Responses to open questions in surveys were coded according to the six themes presented in this figure. Actual number of surveyed attendees who answered this question in each location are as follows: Nuevo Rio Claro #24 and La Nueva Primavera #21.

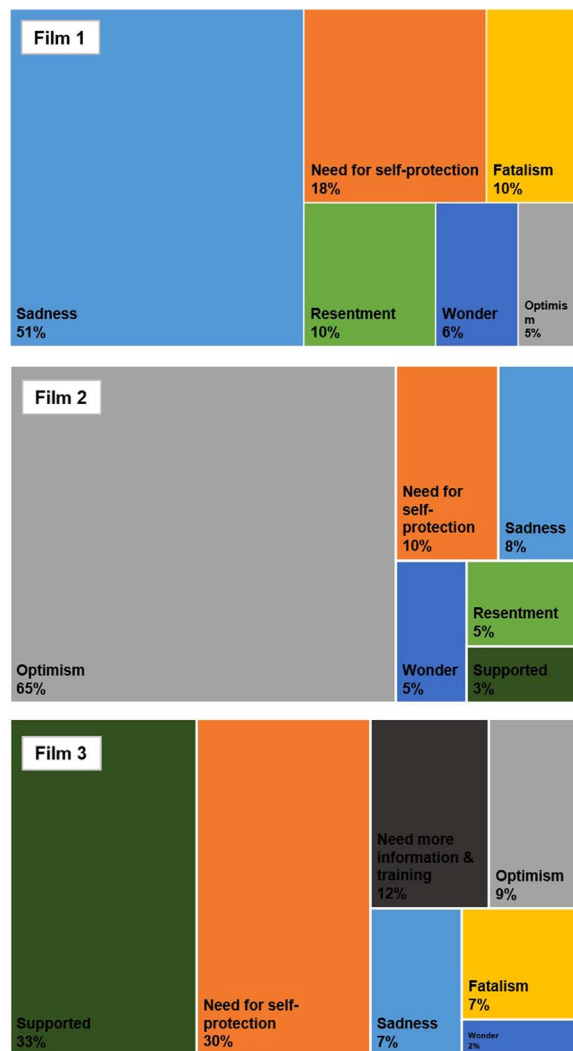


Fig. 10. Verbalised emotional responses to each of the three films across all four settings in Colombia. The question asked was, “What is the main feeling/emotion you get after watching this film”. Responses from group discussions between each film were coded according to the nine themes presented in this figure. Actual number of attendees who responded to this question in each location, per film, are as follows: Nuevo Rio Claro (1st) #14, (2nd) #13, (3rd) #12; La Nueva Primavera (1st) #24, (2nd) #15, (3rd) #5; Armero-Guayabal (1st) #24, (2nd) #17; (3rd) #9; Lérida (1st) #10, (2nd) #10, (3rd) #8.

about feelings of resentment towards the State for what happened, whereas this was not expressed by individuals in any other location:

*“The government was not prepared for the disaster”*

Resident of Armero Guayabal, March 2016

*“There was very little commitment from the authorities and from the people of Armero”*

Resident of Armero Guayabal, March 2016

About a third of those in Lérida and La Nueva Primavera that either responded to this open survey or stated this in group discussion [34 people total] said that film 1 made them feel the need for self-protection:

*“In order to be prepared and avoid another disaster we must not forget”*

Resident of Armero Guayabal, March 2016

*“Film one made me scared and sad about what we experienced, but also made me think that we must be better prepared”*

Resident of La Nueva Primavera, March 2016

*“The main message of this film is exceptional. Memories have been lost and we don’t know what could happen in the future. People must be prepared”*

Resident of Armero Guayabal, March 2016

Despite many people acknowledging the need for self-protection, about a fifth of survey/discussion respondents in L rida and La Nueva Primavera (34 people total) said that film 1 made them feel fatalistic. The generation of this type of response was something we wanted to explicitly avoid as some research suggests that this ‘fear-based’ methods of communicating risk actually encourages a fatalistic attitude (i.e. “there’s nothing I can do about it”) and possibly the transfer of risk elsewhere [31].

Film 2 evoked feelings of optimism (coded from responses of ‘positive thoughts’) for 86% of those surveyed in Nuevo Rio Claro and 72% in La Nueva Primavera. This was also the dominant response from group discussions in Armero and L rida. Several other respondents also recalled the difficulties of recovery and the need for self-protection:

*“I was surprised by the way the survivors reacted after the disaster”*

Resident of La Nueva Primavera, March 2016

*“People were able to recover, but it was hard and sad for people to move forwards”*

Resident of La Nueva Primavera, March 2016

*“It is sad to see, but as humans we must live and should continue looking forward”*

Resident L rida, March 2016

Film 3 brought about a range of emotions in each setting. Over two-thirds of surveyed respondents in Nuevo Rio Claro said that film 3 gave them a feeling of being supported by institutions and a sense of security:

*“More authorities and relief agencies are taking measures and are prepared”*

Resident of Nueva Primavera, March 2016

*“Technology has helped improve a lot and it relieves us”*

Resident of Nueva Primavera, March 2016

Whereas in L rida, no respondents felt this way, with over half feeling that they need more information about the volcano:

*“We need better communication, we can know and see, but we need to communicate”*

Resident of L rida, March 2016

*“Scientists must communicate more with people living in areas of high risk”*

Resident of L rida, March 2016

The majority (80%) of those surveyed in La Nueva Primavera said that film 3 made them realise the need to protect themselves:

*“We must have a family emergency plan”*

Resident of La Nueva Primavera, March 2016

*“The community needs to be better informed and learn more”*

Resident of La Nueva Primavera, March 2016

The dominant reactions to the films were uniform across settings, and independent of first-hand experience of volcanic activity. Film 1 was extremely moving for those that had lived through the tragedy but, for those that had not been affected by the eruption, the films also elicited similar emotional responses. The principal reaction to film 2 (optimism), was very striking, and quite unexpected as this was not an intentional aim for the film:

*“The videos also helped the new generations to remember what happened, but not just to embrace the victim role, but with the second video to realise that no matter what happens, progress is possible”*

Communication and Education Officer, Servicio Geol gico Colombiano, March 2016

This response to film 2 demonstrated that realising people’s capacities to cope and recover was empowering for the audience. It also became a stark and important contrast to fatalistic responses that

might have occurred after viewing film 1. Most importantly, it showed that people from those communities, just like themselves, were able to make a difference to their lives and, therefore, that they, the viewers, are also able to act and make a difference to reduce risk. The reaction to film 3, a combination of feeling supported by institutions and need to self-protect, complemented the other two films and contributed to the overall aim of the films, to empower people to use knowledge and develop preparedness efforts.

The responses to the films show how powerful narrative can be, and how giving people ‘a voice’ can empower them to become engaged in discussion around risk and strengthen, and widen community connections. It also provides evidence for the heterogeneities in experience and response, even for communities threatened by the same volcano, demonstrating that the same risk messages may be received or interpreted in different ways as a consequence of past experience, personal inclination and social and cultural setting.

#### 4.3. The role of both the product and the process for strengthening resilience

For the final part of this discussion, we reflect on the final aim of the films – to strengthen local-to-national lines of communication around risk and response – framed not just around the film itself, but around the role of the film-making process as a tool to create opportunities for participation and involvement in dialogue around risk reduction (e.g., [45]). For this component of the paper, we invited reflections from our project partner monitoring agencies about their experiences of participating in the ‘social learning’ approach<sup>8</sup> we took to creating and using the films (see Boxes 1 and 2).

Additionally, audiences at film screenings also reflected on the benefits of participating in the co-production of the film-making process:

*“I learned a lot from the group discussion”*

Resident of Troumaca, April 2016

*“I want [SRC] to keep up the wonderful work they are doing”*

Resident of Sandy Bay, April 2016

*“Today Nevado del Ruiz is much better monitored and we believe more too”*

Resident of Rio Claro, March 2016

*“I was surprised to see how the different institutions are caring for the communities”*

Resident of Rio Claro, March 2016

These reflections provide evidence for the benefits of our social-learning approach to the film making process. From project inception to the final film screenings, the co-production of the films influenced all participants, in ways that were often transformational. The convergence of all actors in the film-making process (including audiences at screenings) encouraged two-way learning and the generation of and/or strengthening of relationships between (and within) communities, national emergency managers and volcano monitoring agencies. In both settings, representatives from our project partner monitoring agencies joined the film production team as they shot the footage and attended all the film screenings. This extended physical presence was welcomed by local communities as it offered both sets of actors opportunities to communicate with each other about hazard, risk and response. By putting those at risk in charge of telling their story, and by working alongside individuals and communities rather than looking at them as research subjects, all participants in the process were able to shape it, and as such, spaces were created for reflective learning and behaviour change. These goals are familiar for many attempting to follow a participatory process, and while extensively criticised, here we

<sup>8</sup> ‘We’ being all those involved in the film making process: researchers, interviewees, monitoring agency project partners, audiences at screenings, emergency managers and the film crew.

present evidence for achieving those goals in the making of, and response to our films. By deliberately designing the process to not be expert driven or extractive [30], and rather making use of multiple framings of risk (e.g., [51]), our film-making process resulted in indicators of empowerment and change for all, that was not zero-sum [11].

Beyond the development of local to national ties through the film-making process, we also reflect on how the product itself has been an important component in strengthening vertical and horizontal communication around risk. While earlier in the paper we discussed the importance of emotion in positively influence decision-making around risk, we also have learned of the role of aesthetics within the films, not only in generating emotion but as a hazard and risk communication tool in of itself. In both settings, the audiences spoke positively of the beautiful images in the film, both of the volcano and surrounding areas, and of people doing ordinary things.

In St Vincent, the films have already become part of the NEMO communication strategy so are shown widely in-country, and they have also received nearly 20,000 online views worldwide (Table 2). The SRC also intend to incorporate them into future volcano hazard awareness campaigns in other islands and will do so in an upcoming project funded by the Caribbean Development Bank.

Following the final community screening in Colombia, the films were also shown to emergency managers in another location at risk from eruptions from the currently dormant volcano, Cerro Machin. The films were well-received and seen as relevant and useful despite being about an eruption from a different volcano. Comprehension and feelings of relevance about the film's message may be related to cultural familiarity, although this has not yet been systematically investigated with either set of films.

## 5. Conclusions

Regardless of the intended audience the science to be communicated needs to be “useful, useable and used” [2,50] for that audience. In this study, we created oral history films as a vehicle to synthesise, communicate and share knowledge of volcanic risk and, by using surveys and group discussions, we evaluated the immediate influence of the films on learning and affect. Our films focused on experiences from two volcanic disasters: the 1979 eruption of La Soufriere, St Vincent and the 1985 eruption of Nevado del Ruiz, Colombia.

While it is well documented that oral history films can be useful to preserve and share social and cultural memories, we went beyond intuition that this style of output would be an effective medium to communicate volcanic risk. We therefore chose to design the entire film-making process (from concept to screening) as a collaborative experiment with an interdisciplinary team of researchers, volcano monitoring scientists, emergency managers, a professional film crew, and our target audience. This team informed and helped to devise the goals of the films: a) to raise volcanic hazard and risk awareness; b) to foster social and cultural memory of eruptions; c) to empower communities to develop preparedness efforts, and d) to strengthen local-to-national lines of communication around risk and response.

As opposed to taking a top-down, knowledge deficit approach to communicating risk, instead participants of our intended audiences became the leading focus of the films, guiding the viewer through their experiences of an eruption, the story of recovery, and the challenges of having an active volcano as a neighbour. This contrasts strongly with other types of hazard communication where the hazard itself remains front and centre of the film. Further, this co-productive approach afforded greater power equality to participants, particularly the ‘story tellers’ in the film who were able to exercise control over what was said; potentially affording a representation of past events that more closely resembles the situation for communities at risk.

Results from our survey, group discussions, and reflections from project partners provide evidence that both the product (i.e the films)

and, almost more importantly, the act of participating in part or all of the film-making process, were successful in addressing the goals of the films. The films, and the process of social learning, helped to: a) motivate people to actively seek hazard and risk information; b) empower people to turn that new knowledge into risk-reducing actions, and c) strengthen the resilience of individuals, communities and institutions who manage risk. By co-producing films *with* the intended audience, *for* the intended audience, and by disseminating the films at screenings and workshops tailored to address the needs of each at-risk community, we demonstrate that our approach contributed both to improved knowledge, the development of individual and place-based adaptations to mitigate and reduce risk, and strengthened horizontal (cross-community) and vertical (local to national) communication.

This study has illustrated that risk communication is more effective if approaches are integrated into risk reduction strategies and/or research projects from the outset, and not an end-of-project ‘bolt on’. We have shown that risk communication is more effective if the audiences are identified, their needs are known, and they are motivated to participate in the risk communication process itself. We have demonstrated the importance of communicating a message that is salient and relevant to the audience and in a style and format that is appropriate for the context and setting. We have reflected on the importance of using emotion in risk communication to help positively guide thinking and behaviour. By addressing all of these issues, we have provided evidence that communicating risk across hazard contexts and settings can support the management and reduction of risk and strengthen resilience of communities to disasters.

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## Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.ijdr.2017.04.015>.

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