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DOCTORAL THESIS
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INTERNATIONAL MENTION**



**CIENCIA Y CINE: ENCUENTRO DE FRONTERAS
SCIENCE AND FILM: FRONTIERS MEETING**

Doctorando
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Línea de Investigación **PATRIMONIO CULTURAL Y TERRITORIO**
Departamento **HISTORIA DEL ARTE, ARQUEOLOGÍA Y MÚSICA**

TITULO: *CIENCIA Y CINE: ENCUENTRO DE FRONTERAS*

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SCIENCE AND FILM: FRONTIERS MEETING

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TÍTULO DE LA TESIS: CIENCIA Y CINE: ENCUENTRO DE FRONTERAS. SCIENCE AND FILM: FRONTIERS MEETING

DOCTORANDO/A: Samer Angelone (Alassad)

INFORME RAZONADO DEL/DE LOS DIRECTOR/ES DE LA TESIS

(se hará mención a la evolución y desarrollo de la tesis, así como a trabajos y publicaciones derivados de la misma).

El doctorando Samer Angelone (Alassad), con fecha de aceptación en el Programa de Doctorado en "Patrimonio" el 28 de enero de 2016, ha desarrollado de forma satisfactoria tanto las labores de investigación como las actividades de formación que le han sido encomendadas desde el comienzo.

En primer lugar, el doctorando ha llevado a cabo, pormenorizadamente, la búsqueda bibliográfica así como la lectura crítica de algunas de las fuentes principales relacionadas con su objeto de estudio. Estas labores realizadas el primer año de su adscripción al doctorado, han tenido las siguientes finalidades: 1) comenzar a trazar el estado de la cuestión en dos ámbitos disciplinares específicos, por un lado la educación y por otro el estudio del cine aplicado al área de educación; relacionar aspectos y/o elementos de sendos ámbitos científicos para poder asentar el marco teórico de la Tesis Doctoral; y 3) afianzar las bases metodológicas para el estudio del objeto de la Tesis.

Paralelamente, con el fin de acotar mejor los distintos aspectos teóricos-prácticos de la labor investigadora, el doctorando ha abordado, en su segundo año, el análisis una serie de datos y cuestionarios en base a la participación de determinados sectores de la cinematografía y la educación, que le han permitido extraer algunos resultados muy interesantes para su publicación. Igualmente, el doctorando ha realizado una estancia internacional que le permitirá el acceso a la Mención Internacional de Doctorado.

Quisiera destacar que los resultados derivados de la labor realizada hasta ahora por el doctorando se han podido presentar y debatir en los foros adecuados para ello, a saber:

- 7th European Communication conference (ECC2018)

Fecha y lugar: del 31 de octubre al 3 de noviembre 2018; Lugano, Suiza

Oral presentation: Filmmaking courses can help replace the linear narrative of scientist's stories with alternatives.

Igualmente, su investigación ha tenido como resultado cuatro artículos en distintas revistas de impacto:

Angelone S., Soriguer RC, Melendo A (2019) Filmmaking courses for scientists help promote richer alternatives to chronological narratives. *Studies in Higher Education*. DOI:10.1080/03075079.2019.1604651

Angelone S., Soriguer RC, Melendo A (2019) Modes of documentary films produced by the future generation of 'scientists-as-filmmakers'. *International Journal of Science Education*. DOI: 10.1080/21548455.2019.1657251

Angelone S., (2019) A new generation of scientists-as-filmmakers: experiences gained in Switzerland. *Science Communication*. 41(3): 369-377.

Angelone S., Melendo A, Hall M (2019) The creation of science film festivals: lessons from behind the scenes at the Global Science Film Festival. *Educational Media International*(under review)

Angelone S., Capizzi A, Soriguer RC, Melendo A (2019) Searching for identities in the realm of environmental film festivals. *International Journal of Event and Festival Management*(under review)

En lo que atañe al plan de formación, y debido a su grado de Doctor, muchas de las actividades formativas que debía realizar le fueron convalidadas. En todo caso, quisiera hacer hincapié en el hecho de que en aquellas que ha debido llevar a cabo han tenido un alto grado de aprovechamiento.

Por último, quisiera hacer constar el elevado grado de compromiso que el doctorando ha puesto siempre de manifiesto, compatibilizando la investigación con sus obligaciones profesionales.

Por todo ello, se autoriza la presentación de la tesis doctoral.

Córdoba, 4 de noviembre de 2019

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Acknowledgement



Photography from the Closing Ceremony at ‘Life Science Career Day’ Lausanne 2019

I am forever grateful for all who made this dream reality. The unlimited support of my supervisor, Dr. Ana Melendo, was pivotal during these four years of intensive research, writing and publishing. Dr. Ramón C. Soriguer was the reason why I started my studies at Córdoba University. He was my supervisor during my genetic studies, but he was also the one who showed me the way to film studies. Dr. Marcus Hall and Dr. Elena Conti are pure inspiration for science and film. They were my real support and motivation during the last years. Gaetano Capizzi was my model and guide for film festivals organisation. I also have to thank the hundreds of PhD students, post-doc and researchers who participated in my workshops and my studies, and supported the film festival.

This thesis is for my family, Sonia, Shireen and Malik!

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I. Introduction/Introducción

(Tesis como compendio de publicaciones: Introducción, o parte preliminar, en la que se expliquen los objetivos e hipótesis del plan de investigación desarrollado en la tesis. Se debe justificar aquí claramente la unidad temática de la Tesis desarrollada a través de diversas comunicaciones científicas.)



Photography from the 'Global Science Film Festival', Zurich 2017

Justification of the thematic unity of the thesis/Justificar la unidad temática de la tesis desarrollada a través de diversas comunicaciones científicas

Un desafío enorme al que los científicos se enfrentan es como comunicar conceptos complejos y contenido detallado de forma eficaz para el público en general. Los films enganchan visualmente, acústicamente, y emocionalmente al público. Así que los científicos deben aprovecharse de estos beneficios que los films otorgan para comunicar sus hallazgos y experiencias. De esta forma pueden usar los films en diferentes contextos; desde documentar sus trabajos de campo y laboratorio, hasta mostrárselo al público en general. Recientemente ha habido una explosión en la demanda de films científicos. Esta demanda tan enorme no se puede, y nunca será, satisfecha exclusivamente por cineastas profesionales. Los mismos científicos pueden sustituir a los cineastas profesionales, pero les falta educación

cinematográfica; teoría (storytelling, narrativas y storyboarding) y práctica (operar cámara, sonido, luz, y editar).

Para satisfacer el mercado de films científicos, universidades y institutos de ciencia están, de forma creciente, enseñando a sus científicos y estudiantes como producir sus propios films, a través de cursos acreditados mediante programas de comunicación científica. Estos programas están produciendo una nueva generación de '*científicos-cineastas*'. Lo que definimos como "una generación que asimile la producción de films como una parte de su formación académica, aunque no en una forma profesional". Hay muchas formas de promocionar esta nueva generación. La forma más potente es a través de ofrecerles plataformas (básicamente festivales de cine) donde pueden enseñar sus films y discutirlos con cineastas profesionales.

El tema de una nueva generación de '*científicos-cineastas*' es muy reciente y ha tomado fuerza en los últimos cinco años, y por lo tanto no hay ningún estudio que aborde: 1) esta nueva generación, 2) los cursos que se le están ofreciendo, 3) como se evoluciona el aprendizaje de esta nueva generación, y 4) como promocionar esta nueva generación a través de organizar festivales de cine, donde pueden exponer sus films y discutirlos con profesionales del cine.

La presente tesis doctoral intenta abordar el tema de una nueva generación de '*científicos-cineastas*', en tres aspectos:

I. Dar a conocer a esta nueva generación de '*científicos-cineastas*', y clasificar y analizar, usando atributos y criterios comunes, los cursos de 'hacer films para científicos' que se ofrecen globalmente, pero con especial enfoque en Suiza.

Estos aspectos se abordan en el Capítulo 1

II. Analizar la evolución del aprendizaje de los científicos que acuden a estos cursos de 'hacer films para científicos', y como van a afectar a los futuros films que la nueva

generación de '*científicos-cineastas*' va a producir. Como ejemplos se analizan las estructuras narrativas y los modos (modalidades) de los films.

Estos aspectos se abordan en los Capítulos 2 y 3

III. Como promocionar la nueva generación de '*científicos-cineastas*' a través de la organización de festivales de cine científico. En esta tesis doctoral aportamos nuestra amplia experiencia en organizar el Global Science Film Festival (www.sciencefilm.ch) en Suiza. También reportamos un análisis robusto de los festivales de cine ambiental. Ya que los festivales de cine ambiental son los festivales mas conocidos y abundantes dentro de los festivales de cine científico. Así mismo preparamos un guía práctico para los científicos que deciden hacer films.

Estos aspectos se abordan en los Capítulos 4, 5 y 6

General introduction/Introducción general

Scientists-as-filmmakers

A major challenge facing all scientists is how to communicate complex concepts and detailed content in ways that are appealing to a wider audience. Film engages viewers visually, aurally, viscerally and emotionally, and potentially reaches a vast audience (Berlin, 2016). Hence, scientists can benefit from the inspirational, educational and motivational power of films to communicate their knowledge and expertise. Films are powerful tools of scientific communication and can be used in a number of different contexts ranging from providing a documentary record of fieldwork and laboratory experiments, via multimedia exposure and public exposition, to science outreach aimed at bringing the general public into closer contact with scientific research (Pascuali, 2006 & 2007). Recently, there has been a boom in demand for science films (Career Feature, 2018; National Academy of Sciences, 2008). This expanding demand cannot be – and will never be – satisfied exclusively by professional filmmakers. Scientists can in many cases replace professional filmmakers, although the technical skills for filming and editing – as well as those required for developing strong narratives – lie beyond their training as academic scientists.

To satisfy the market demand for science films, universities and scientific institutes are increasingly teaching their scientists and students how to produce their own films via accredited filmmaking courses that form part of science communication programs. These science-film-making courses are producing a new generation of ‘*scientists-as-filmmakers*’, which we define as “scientists who assimilate filmmaking as part of their academic preparation, albeit not in a professional way”.

Although science-film-making courses are becoming more and more popular worldwide, the classification and analysis of the offered courses globally is a tough task since these courses are usually only internally advertised (i.e. within universities and research

institutes). Hence, we focused this thesis on science-film-making courses offered in Switzerland since we have first-hand knowledge of the majority of such courses and am also a teacher on some of them.

Since the eighteenth century Switzerland has been regarded as one of the world's most successful nations in terms of scientific production. High investment in science has helped Switzerland move up in the university rankings (Kupper & Schaer, 2015; <https://www.theguardian.com/higher-education-network/blog/2014/oct/01/switzerland-university-rankings-invest-research-science>). Thus, our analyses are representative of the world's developed countries but could also serve as a model for developing the curricula of science-film-making courses in developing countries.

Narratives of the science documentary films

Although 'narrative' and 'story' are often used as synonyms in informal contexts, these two concepts are somewhat different in meaning. A story refers to the content, that is, the events (actions) and existences (settings and characters) that are being related, while narrative is more concerned about the how this content – via points of view, narrative voices and plots – is presented to readers/audience (Chatman 1980). Two temporal sequences combine in every narrative: I. chronological time in which events unfold (story time) and II. narrative time, that is, the time it takes for events to be told (Genette 1983).

A non-linear narrative is a storytelling device that does not portray the events of a story in chronological order; this may mean a reverse order, going back and forth between past and future events, or even switching between one parallel plot and another (Kim et al. 2018). Appreciating and applying non-linear narratives is not necessarily an intuitive task due to the often complex temporal disruptions in event sequences and the non-explicit recording of the temporal order of the story (Kim et al. 2018).

Scientists tend to communicate their scientific stories using linearly (chronologically) structured narratives based on the classical main sections of scientific manuscripts: Introduction, Material & Methods, Results and Discussion IMRAD (Sollaci & Pereira 2004). Indeed, even the sub-sections are chronologically presented (e.g. in Material and Methods fieldwork comes before laboratory work) and, given the nature of scientific publications and presentations, it is understandable that this tendency is closely adhered to. Consequently, it comes as no surprise that linear narratives are dominant – due to force of habit – when scientists make films and that the alternative types of narratives that film as a media offers are rarely taken into account.

It is not clear how these courses will affect the films produced by the next generation of '*scientists-as-filmmakers*'.

Modes of the science documentary films

In his book *Introduction to Documentary*, the American documentary theorist, Bill Nichols (2001) distinguished and discussed six documentary modes based on particular traits and conventions (poetic, expository, observational, participatory, reflexive and performative) used by documentary makers either consciously or simply because they represent filmmakers' chosen way of telling their stories and sharing their knowledge.

Documentary modes are not mutually exclusive and the same documentary may make use of one or more of the six above-mentioned modes. There is often significant overlap within one documentary (Nichols 2001). "The characteristics of a given mode function as a dominant in a given film...but they do not dictate or determine every aspect of its organization", highlighted Nichols (2001). Understanding documentary modes, their traits and conventions is essential not just for teaching filmmakers how to analyse documentaries but also for helping them to create their own documentaries.

Through force of habit, scientists untrained in filmmaking most often choose the expository mode since it possesses the same traits and conventions as are present in most scientific narratives (e.g. scientific papers and presentations) (Sollaci & Pereira 2004; Olson 2015). Nevertheless, this need not be the case in ‘*scientists-as-filmmakers*’ who have been taught how to appreciate and use different documentary modes, and how they can be employed for communicating science to their peers and the general public.

Despite this, it is not clear how these filmmaking courses will affect future documentaries produced by a new generation of ‘*scientists-as-filmmakers*’.

Science film festivals

Recently, there has been a proliferation in the demand for science films (Gouyon, 2015; Agrawal, 2001; Career Feature, 2018; National Academy of Sciences, 2008) and, as a result of this boom, science film festivals have burgeoned in recent decades (e.g., Bristol Science Film Festival <https://brisscifiilm.wordpress.com>; Science Film Festival from Goethe Institute www.goethe.de/ins/th/prj/wif/fes/enindex.htm; Imagine Science Films <http://imaginesciencefilms.org>; Festival International du Film Scientifique Pariscience <https://pariscience.fr>; and Academia Film Olomouc <https://afo.cz>).

Science film festivals are thematically restricted events. They are more than just simple platforms for science film circulation as they aim to “promote science literacy and awareness of contemporary scientific and technological issues through film” (e.g. Science Film Festival from Goethe Institute) and “promote a high-level dialogue between scientists and filmmakers” (e.g. Imagine Science Films Festival).

The increase in the number of science film festivals (Hoffman, 2008; Bultitude, McDonald, & Custead, 2011) is part of a generalised global increase in the number of film festivals; indeed, in 2010 industry experts estimated that around 3,500 film festivals are held annually worldwide (Rüling & Pedersen 2010). Nowadays, we have no clear idea of the true

current number of film festivals, although it is evident that numbers are growing significantly or even exponentially.

In the light of the growing scale and importance of film festivals, academic studies are now part of film and media studies (Archibald & Miller 2011; De Valck & Skadi 2009; Papadimitriou & Ruoff 2016; <http://www.filmfestivalresearch.org>). Even so, science film festivals have still not received any scholarly attention.

Communicating science to the lay public is widely recognized as a responsibility of scientists, and hence general consensus exists within the scientific community that scientists outreach educational programs are needed, to restore the broken bridge between science and society (Leshner, 2003). Outreach training should not focus simply on increasing public understanding of science, because the problem is not merely a lack of scientific comprehension. The problem is more about public engagement than public understanding of science (Leshner, 2007; Vesterinen, Tolppanen & Aksela, 2016). Hence outreach educational programs need to be broadening, and one of the outreach training top priorities should deal with science events planning and management, and specially science film festivals (Angelone 2019).

Environmental film festivals as thematic (ecology) science film festivals

Environmental film festivals are thematically restricted festivals that are more than just simple platforms for eco-cinema circulation since they also act as meeting places where filmmakers and audiences can interact face-to-face (Monani 2013). They challenge, inspire and motivate people to go out and make a difference to their worlds by undertaking some kind of environmental action (Malamud 2008). Environmental film festivals stress the democratic nature of popular participation. Audience are encouraged to interact with festival organizers and filmmakers within a setting that inspires conversation and dialogue. They are not simply

forums for general entertainment since, in addition, they inspire and bring communities together in a common cause.

Environmental film festivals have received little scholarly attention. Monani (2013) took the first step in her article *Environmental Film Festivals: Beginning explorations at the intersections of film festival studies and ecocritical studies*. In this initial attempt to theorize the notion of environmental film festivals, Monani (2013) used the phrase the “written festival”, a term coined by Daniel Dayan to highlight the printed material produced by and about a festival (Dayan 2000). Monani (2013) examined the websites of numerous environmental film festivals in an attempt to understand how they constructed their public identities. She concluded that all festivals appear to champion ideas pertaining to both the public and the alternative public spheres; yet, when she probed a bit deeper, it became obvious that festivals varied considerably in their commitment to these notions (Monani 2013). Few environmental film festivals fell neatly into a single end-member category. When they construct and negotiate identities in the public spheres or alternative public spheres, and/or as trade shows, the complex ways in which these festivals work to establish their presence in a heterogeneous environmental and media landscape quickly become obvious.

Monani (2013) invited eco-cinema critics to further analyse environmental film festivals, and asked additional questions about their role and place in environmental and cinematic discourse and action. Her paper inspired us to go beyond the public sphere mode and search more deeply for identity modes in the realm of environmental film festivals.

In this doctoral thesis we decided to analyse and study the environmental film festivals, because they are somehow thematic (ecology) science film festivals. The abundance of these film festivals (much more than science film festivals) allow us better analyses, and hence better conclusions to how science film festivals could work.

Before scientists jump aboard the science-film!!!

Science films are mainly made by '*scientists-as-filmmakers*', or that they are the result of collaborations between scientists and professional filmmakers. However, many scientists jump aboard the science-film boat without any preparation, which potentially has two unwanted consequences: failed films and/or many wasted hours of miscommunication between scientists and filmmakers.

By 'failed science films' we refer to both i) cinematographically failed films due to a poor knowledge of filmmaking techniques (storytelling, narrative, framing, lighting, editing, and so forth) and/or ii) science films that do not match the desired contexts, audiences and goals that scientists hope for. Hence, it is pivotal that scientists are familiar with some essential peculiarities of film as a media before they make their own films or collaborate with filmmakers.

II. Hypothesis and objectives/Hipótesis y objetivos

(Tesis como compendio de publicaciones: Hipótesis y objetivos a alcanzar, indicando en que publicación o publicaciones se abordan.)



Photography from the 'Global Science Film Festival', Zurich 2019

Hypothesis and objectives

The aims of this doctoral thesis are to

Describe the boom of the new generation of '*scientists-as-filmmakers*', and to classify and analyse using common traits and conventions the science-film-making courses offered by, above all, Swiss universities and research institutes (Chapter 1).

Understand and predict how filmmaking courses will affect the narrative structures used in future documentary films produced by the new generation of '*scientists-as-filmmakers*' (Chapter 2).

Appreciate and predict how filmmaking courses may affect the documentary modes used in future documentary films produced by the new generation of '*scientists-as-filmmakers*' (Chapter 3).

Report behind-the-scenes experiences organizing a new science film festival using the Global Science Film Festival (www.sciencefilm.ch) as an educational model (Chapter 4).

Create and analyse five main identity modes in the realm of environmental film festivals (as thematic, ecology, science film festivals): I. name (environmental claims, location and scale), II. timing (frequency of creation, periodicity, time of year and duration in days), III. public (target public: general public, alternative public or corporate public, ticket prices and scale), IV. film (submission scale and film selection criteria), and V. organisational (organizers and sponsors) identity (corporates, governments, NGOs and academies) (Chapter 5).

Provide scientists with essential knowledge to ensure that science film stories, narrations and modes match with the desired contexts, audiences and goals of science films (Chapter 6).

Hipótesis y objetivos

Los objetivos de esta tesis doctoral son

Describir la emergencia de la nueva generación de '*científicos-cineastas*', y clasificar y analizar, usando atributos y criterios comunes, los cursos de 'hacer films para científicos' ofrecidos por, sobre todo, universidades y centros de investigaciones suizos.

Entender y predecir como los curso de 'hacer films' afectarán las estructuras narrativas usadas en los futuros documentales producidos por la nueva generación de '*científicos-cineastas*'.

Apreciar y predecir como los cursos de 'hacer films' podrían afectar lo modos de los documentales de los futuros films producidos por la nueva generación de '*científicos-cineastas*'.

Reportar las experiencias 'detrás de la escena' de cómo organizar un festival de cine científico usando el Global Science Film Festival (www.sciencefilm.ch) como modelo educativo.

Crear y analizar cinco modos de identidades mayores de los festivales de cine ambiental (considerando los festivales ambientales como festivales temáticos, ecología, de los festivales de cine científico): I. nombre (como reclamar que se tratan de temas ambientales, su localidad y escala), II. tiempo (frecuencia de crear los festivales, periodicidad, en que mes, y duración en días), III. público (público general, público alternativo, y público cooperativo), IV. film (escala de presentación de films al festival, y los criterios de selección), y V. organización (organizadores y patrocinadores: corporativas, gubernamental, NGOs, y academias).

Proporcionar a los científicos un conocimientos esenciales para asegurar que las historias, narrativas y modos de los films científicos coinciden con los deseados contextos, públicos y objetivos de los films científicos.

III. Methods/Métodos



Photography from the workshop ‘Storytelling Science at Locarno Film Festival’, Locarno 2018

Scientists-as-filmmakers

There is a general consensus in Swiss universities and scientific institutes that scientific outreach programmes are needed, mainly to bridge the gap between science and society (Leshner, 2003). Hence Swiss universities and scientific institutes established and funded numerous outreach programmes, among them filmmaking courses (Angelone, 2019).

We were responsible of establishing the curricula and teaching these courses. Science filmmaking courses in Switzerland vary greatly in name, duration, context, target audience and goals, and so we have grouped them into three main categories based on their most observable traits and conventions:

- Theoretical science filmmaking courses (usually called ‘storytelling and storyboarding science’ and variations thereof).

- Practical science filmmaking courses (usually called ‘filmmaking for scientists’ and variations thereof including ‘video-abstract’ and ‘video-journalism for scientists’).
- Competitive-based science film production (usually called ‘science filmmaking marathon’ and variations thereof).

Our study included 102 scientists (mainly PhD and post-doctoral students) from nine Swiss universities and research centres: seven universities (Zurich, Geneva, Lausanne, Fribourg, Neuchatel, Basel and ETH Zurich) and two research centres (Swiss Federal Institute for Forest, Snow & Landscape Research WSL, and Swiss Federal Institute of Aquatic Science & Technology EAWAG). The organisers worked together on common programmes in the preparation of some of filmmaking courses. For example Life Science Zurich (which includes Zurich University and ETH Zurich) worked in close collaboration with the Conférence des Universités de Suisse Occidentale (which includes the universities of Geneva, Lausanne, Bern, Fribourg and Neuchatel). The participants, of whom 73 were women and 29 men, had different scientific backgrounds.

Narratives and modes of the science documentary films

The participants in all courses were taught to recognize and apply four alternative narrative structures that we believe are appropriate for simple science films:

- Two *in media res* structures; namely *before climax-backwards* and *end-backwards*
- *Parallel* and *frame* structures

Participants were also taught to recognize and apply the six documentary modes described by Nichols (2001) in his book *Introduction to Documentary*; namely poetic, expository, observational, participatory, reflexive and performative.

To avoid possible bias in the design and analyses of our study:

- One person, Samer Angelone, taught all courses.

- Even when filmmaking courses had different aims (learning theoretical or practical parts of filmmaking, producing films and/or borrowing narrative attributes and techniques of storytelling from filmmakers), duration (two–five days) and target audiences, the same didactical materials were used to teach participants how to recognize and apply narrative structures and documentary modes.

Questionnaire for the narratives

Before the filmmaking courses began, the technical descriptions of different narrative structures (*before climax-backwards*, *end-backwards*, *parallel* and *frame*) were unfamiliar to participants. Even if participants did recognise certain narrative structures, they were unable to give them a name, and hence it was not possible to run the questionnaire at the beginning of the courses. To solve this problem, participants were asked at the beginning of the courses to think and write down all details (story, storyboard and the structure of the plot) about the films that they would like to make in the future. After having decided upon the details of the films (including the narrative structure, even if they were unaware of this technical terms) that they would like to film, participants were taught the four above-mentioned alternative narrative structures. Then, participants responded to a questionnaire about the narrative structures that they would have used before beginning the filmmaking courses and the ones that they would use after attending the courses. Each participant could choose more than one narrative structure.

Questionnaire for documentary modes

The same as for the narrative structures, before answering the questionnaire, participants were asked to think in detail about the films that they would like to make in the future. With a clear vision in mind, participants were then taught the six documentary modes (Nichols, 2001). Finally, participants answered the questionnaires regarding the documentary modes that they would have used before attending the filmmaking courses and the ones that they would use in light of the course content. Each participant could choose more than one documentary mode.

Statistical analyses

To compare between the frequencies of the chosen narrative structures and documentary modes before and after the courses, a frequency analysis χ^2 (Pearson's Chi-squared test X-squared) was used. Fisher's Exact Test for Count Data was employed to compare the frequencies of the chosen narrative structures and documentary modes for female and male participants, and to compare the results obtained from the different courses (filmmaking for scientist, storytelling and storyboarding science, and science filmmaking marathon). Non-parametric statistical tests (Wilcoxon signed rank test with continuity correction and Spearman's rank correlation coefficient) were applied to compare the number of types of narratives and documentary modes that would have been used before and after the filmmaking courses. All analyses were carried out using R Package V.2.15.1 (R Development Core Team, 2008).

Science film festivals

In this thesis we report our own experience in organising the Global Science Film Festival in Zurich. This is based on studying and analysing the existent science film festivals, and on our own experiences working with Locarno Film Festival (Locarno, Switzerland), Visions du Réel Film Festival (Nyon, Switzerland), Cinemambiente Film Festival (Turin, Italy) and Planet in Focus (Toronto, Canada).

Environmental film festivals as thematic (ecology) science film festivals

General science film festivals are growing, but they are still limited in number. This does not allow us to make robust analyses and obtain reliable conclusions, hence we decided to study and analyse environmental film festivals as thematic (ecology) science film festivals.

We collected data from sixty-four environmental film festivals

- Thirty-eight film festivals form part of the Green Film Network (GFN), which “brings together some of the major film festivals that happen annually around the globe with

focus on environmental issues”. The network aims “to coordinate the events of the associated festivals, promote and distribute films worldwide and encourage initiatives and projects that might help people ponder about the environment” (<http://greenfilmnet.org>).

- The other 26 film festivals were taken from the paper published by Monani (2013), and the web sources www.ecology.com (<http://www.ecology.com/2011/09/11/environmental-film-festivals/>), and www.filmfreeway.com.

The study employed a mixed method, website analysis and questionnaire responses.

Survey questionnaires

We contacted 35 film festivals from the Green Film Network, and 30 of them agreed to answer our questionnaires. Questionnaires included likert scale and open-ended questions. We used their replies to analyse the public, film, and organization identity modes.

For the public identity and to identify which kind of people attend environmental film festivals. We asked environmental film festivals to describe their public by awarding a total of 10 points to three categories of public (general, alternative and business). We also asked the environmental film festivals to describe the public they aimed to attract; likewise, they answered by awarding a total of 10 points to the three categories of public they hoped to attract (general, alternative or business).

Website analyses

The websites of the other 34 film festivals were analysed. These analyses were included (together with the other 35 film festivals from the GFN) in the analyses of the name and timing identity modes.

Statistical analyses

Frequency analysis χ^2 (Pearson's Chi-squared test X-squared), Fisher's Exact Test for Count Data, Nonparametric Statistical Tests (Wilcoxon signed rank test with continuity correction

and Spearman's rank correlation coefficient) and General Linear Models were applied using R Package V.2.15.1 (R Development Core Team 2008).

Before scientists jump aboard the science-film!!!

Based on our own experience, of making science films, teaching filmmaking for scientists and judging films at science film festivals, we learned that scientists need to be familiar with certain relevant peculiarities of science films before making their own films or collaborating with filmmakers. The analyses were based on Context, Audience, Goal, Personal Engagement, Story, Narrative, Mode, Length, Style, and Concept Presentation.

IV. Publications/Publicaciones

(Tesis como compendio de publicaciones: Copia completa de las publicaciones, ya sean publicadas o aceptadas para publicación, haciendo constar el nombre y adscripción de la autoría, en su caso, así como la referencia completa de la revista o editorial en la que los trabajos hayan sido publicados o aceptados para su publicación en cuyo caso se aportará justificante de la aceptación de la revista o editorial, o se acreditará que la publicación es de Open Access. De no contar con los permisos indicados, la Tesis publicable sólo incluirá la referencia a dichos artículos, pero no la publicación ni el acceso a los mismos; en este caso se podrá incluir un resumen explicativo del artículo. A la Comisión Académica del Programa de Doctorado y a los miembros del tribunal se les entregará un versión con la integridad de los artículos aportados.)



Photography from the award ceremony of the 2nd Global Science Film Festival, Zurich 2019

Chapter 1

A new generation of ‘*scientists-as-filmmakers*’: Experiences gained in Switzerland

Paper already published

Angelone S (2019) A new generation of ‘*scientists-as-filmmakers*’: experiences gained in Switzerland. *Science Communication* 41(3): 369-377.

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Photography from the workshop ‘Filmmaking Marathon’, Zurich 2017

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Abstract

Film is one of the most powerful tools for communicating science to peers and the general public. Recently, there has been a boom in demand for science films. To satisfy the demand for science films, universities and scientific institutes are now increasingly teaching their scientists and students how to produce their own films via accredited science filmmaking courses, which now form part of science communication programs. These courses are producing what I define as *a new generation of scientists-as-filmmakers*—that is, scientists who integrate filmmaking into their academic preparation, albeit in a nonprofessional way. The aim of this article is (1) to describe the boom of this new generation of scientists-as-filmmakers and (2) to use common traits and conventions to classify and analyze the science filmmaking courses offered by Swiss universities and research institutes. This study could help promote a new generation of scientists-as-filmmakers and stimulate other countries to design specific programs for training scientists in science filmmaking.

Keywords

science communication, filmmaking, education, academies, storytelling, storyboarding, filmmaking marathon

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A major challenge facing all scientists is how to communicate complex concepts and detailed content in ways that are appealing to a wider audience. Film engages viewers visually, aurally, viscerally, and emotionally, thereby potentially reaching a vast audience (Berlin, 2016). Hence, scientists can benefit from the inspirational, educational, and motivational power of films to communicate their knowledge and expertise. Films are powerful tools of scientific communication and can be used in a number of different contexts ranging from a documentary record of fieldwork and laboratory experiments, via multimedia exposure and public exposition, to science outreach aimed at bringing the general public into closer contact with scientific research (Pasquali, 2006, 2007). Recently, there has been a boom in demand for science films (Kwok, 2018; Loverd, ElShafie, Merchant, & Gerbin, 2018). This expanding demand cannot be—and will never be—satisfied exclusively by professional filmmakers. Scientists can in many cases replace professional filmmakers, although the technical skills for filming and editing—as well as those required for developing strong narratives—lie beyond their academic training as scientists.

To satisfy the market demand for science films, universities and scientific institutes are increasingly running accredited filmmaking courses that form part of science communication programs to teach their scientists and students how to produce their own films. These science filmmaking courses are producing what I define as *a new generation of scientists-as-filmmakers*—that is, scientists who integrate filmmaking into their academic preparation, albeit in a nonprofessional way. This term is different from the idea of *scientists-turned-filmmakers* that describes scientists who make the transition from science to the world of professional filmmaking (Agrawal, 2001).

Although science filmmaking courses are becoming ever more popular worldwide, the global classification and analysis of these courses is complex since many are only advertised internally (i.e., within universities and research institutes). Hence, I have focused this analysis on the science filmmaking courses offered in Switzerland, where I teach on such courses and have firsthand knowledge of many others.

Since the 18th century, Switzerland has been one of the world's most productive nations in terms of scientific output (Kupper & Schaer, 2015). With a population of only 8 million, Swiss scientists have been awarded 21 scientific Nobel Prizes, thereby occupying the third position in the world ranking of the number of Nobel laureates per capita (BBC, 2010). Two Swiss universities, the Swiss Federal Institute of Technology and the École Polytechnique Fédérale de Lausanne, are in the top 20 of the Quacquarelli Symonds rankings; seven Swiss universities are in the top 200 in both the Quacquarelli Symonds and the Times Higher Education rankings (“Why

Does Switzerland Do,” 2014). Furthermore, Switzerland is the world leader in the number of the scientific publications per capita (Academia Stack Exchange, 2018); 39% of its publications are open access, and worldwide it occupies the top spot for open access publishing (European Commission, 2018). This success is partially attributable to researchers from other countries (57% of the total researchers) since Switzerland has the highest proportion of foreign researchers of any country in the world (Dessibourg, 2012). Thus, the experiences gained on science filmmaking courses in Switzerland could be useful in other countries that are currently exploring ways to involve scientists in filmmaking.

Science filmmaking courses in Switzerland vary greatly in name, duration, context, target audience, and goals, and so I have grouped them into three main categories based on their most observable traits and conventions:

1. *Theoretical science filmmaking courses* (usually called “storytelling and storyboarding science” and variations thereof)

In these courses, scientists learn storytelling, narrative and documentary modes, film genres, script, storyboarding, and the theory of film editing.

The main aims of these 2- to 4-day courses are as follows:

- a. To learn how to borrow communication strategies and techniques from film by incorporating the attributes of film narrative. This helps scientists prepare persuasive presentations and publications that will enthrall audiences and increase uptake.
- b. To encourage collaboration between scientists and professional filmmakers. Scientists should be trained to be able to translate their research into elegant and convincing cinematographic stories, thereby facilitating communication with filmmakers and helping them transform scientific stories into films.

In conclusion, knowledge of the language of storytelling and storyboarding has a direct application for science films (successful collaboration between scientists and professional filmmakers) and can also help improve oral and written scientific communications (Dahlstrom, 2014; Jones & Crow, 2017; Martinez-Conde & Macknik, 2017; Olson, 2015).

These courses are usually combined with visits to film festivals (e.g., Locarno Film Festival, Visions du Réel International Film Festival Nyon, and Global Science Film Festival; see Figure 1), which teach scientists how to analyze screened films from a storytelling point of view and give them the opportunity to discuss storytelling with professional filmmakers. This kind of



Figure 1. Photograph of the course *Storytelling and Storyboarding Science* held at the Locarno Film Festival in 2018.

Note. The course was organized by the Swiss Academy of Sciences and the Science Film Academy. Participants came from 12 Swiss universities and research institutes.

course does not require any special equipment (camera, lighting, sound recording, or editing) and so can accommodate a large number (up to 50) of participants (e.g., Swiss Academy of Sciences SCNAT, 2018).

2. *Practical science filmmaking courses* (usually called “filmmaking for scientists” and variations thereof including “video abstract” and “video journalism for scientists”)

In these intensive practical courses, scientists are taught to make their own films. Over 2 to 5 days, participants learn mainly how to operate cameras, handle lighting and sound equipment, and use editing software. The theoretical part (storytelling, storyboarding, and script writing) plays a secondary part since the core of these courses is the practical aspect of filming. The need for specialized teaching equipment (e.g., cameras, lighting and sound equipment, and editing software) limits the number of participants to 10 to 15 (e.g., Conférence Universitaire de Suisse Occidentale, 2018). Although the practical part of these courses consists of producing short films (video abstracts or video reports), their aim is essentially to practice filmmaking and not to produce per se films as a final product.

3. *Competitive-based science film production* (usually called “science filmmaking marathon” and variations thereof)

In these usually competitive 3- to 4-day courses, scientists and filmmakers (25–40 in number) work in small groups (e.g., four scientists and one filmmaker) to produce films. Either shortly before or during the course, some of these courses also teach scientists basic filmmaking techniques such as storytelling, storyboarding, scriptwriting, and how to operate camera, lighting, sound, and editing equipment. At the end of the marathon, the resulting films are usually screened before the public and a jury. Awards are given to the best films. Some of these filmmaking marathons are intensive, while others have long intervals between sessions (i.e., 4 intensive days of work spread out over a period of 2–3 months) and aim to give scientists more time to produce films related to their work (e.g., Swiss Academy of Sciences SCNAT, 2017). The drawback is that scientists do not necessarily learn how to make films themselves as they still have to rely on filmmakers. Scientists mainly provide the ideas and possibly the story, while the filmmakers take charge of the actual making of the films.

Although the participants in these three main categories of science filmmaking courses are mainly PhD or postdoctoral students, some courses also accept undergraduate students, research assistants, and academic staff. Participants usually receive 1 to 2 credit points depending on the duration of the course.

Since 2014, a total of 13 Swiss universities and research institutes have organized annually one or more types of science filmmaking courses (Table 1) that have become popular among scientists. They are quickly booked up, and there are long waiting lists, as occurred on my recent course “Storytelling and Storyboarding Science” at the Conférence Universitaire de Suisse occidentale CUSO (Universities of Geneva, Lausanne, Fribourg, and Neuchatel): It accommodated 14 PhD students, and there were 17 more students on the waiting list. This encouraged the organizers to offer a second course that ran at the same time. Films produced during the courses are usually uploaded directly onto the organizers’ YouTube channels and are visited hundreds of times. Films from the filmmaking marathons are often screened and discussed with the wider public in special events in city cinemas. For example, the best films from the filmmaking marathon in Zurich were shown in a cinema—which sold out—to 270 spectators during the Global Science Film Festival of 2017. The most important aspect of these filmmaking courses is not the films that are produced per se; rather, the key is that the scientists that attend filmmaking courses will go on to produce their own films after the courses even if they lack full professional funding.

Table 1. Details of the Analyzed Science Filmmaking Courses Offered by Swiss Universities and Research Institutes Since 2014.

Course name (with some variations)	Course content	Practical parts	Film outcome	Competition based?	Duration	Main target public	Number of participants	Credit year of course	First year of course	Course organizers	References
Storytelling and storyboard science	Storytelling, script, and storyboarding techniques. How to transform scientific narratives into film stories. How to communicate with professional filmmakers	Attending film festivals to watch and analyze screened films and talk with filmmakers about their stories and storyboards	No	No	2-4 days intensive + attending film festival	Very wide range: undergraduate, master's, PhD, and postdoctoral students; associate researchers; and lecturers	10-50	2	2017	Swiss Academy of Sciences, Diactica (ETH and Zurich University), Department of Evolutionary Biology and Environmental Studies (Zurich University), Locarno Film Festival and Global Eco Film Festival	For example, Swiss Academy of Sciences SCNAT (2018)
Filmmaking for scientists	No filming exercises	Filming interviews or simple short films	No	No	2 days intensive	Not only PhD students but also postdoctoral students are considered		1	2016	Conférence des Universités de Suisse Occidentale (Universités de Genève, Lausanne, Bern, Fribourg, and Neuchâtel), Paul Scherrer Institute	For example, Conférence Universitaire de Suisse Occidentale (2018)
	With filming exercises	Producing short films, video abstracts, and video reports	Yes, but with very limited resources and time	No	4-5 days intensive		10-15	2	2014	Life Science Zurich (ETH and Zurich University), Basel University (GRACE), and Zurich-Basel Plant Science Center (ETH, Zurich University and Basel University)	For example, Basel University (2018)
Filmmaking narration	Scientists are taught the basics of filmmaking	The basics of filmmaking (storytelling, script, storyboarding, and editing techniques. How to work with camera and lighting and sound equipment). Scientists and filmmakers produce short films	Yes, but with limited resources and time	Typically, yes	4 days intensive	Not only PhD students but also master's and postdoctoral students and researchers are considered	25-40		2016	Swiss Academy of Sciences, Life Science Zurich (ETH and Zurich University), Conférence des Universités de Suisse Occidentale (Universités de Genève, Lausanne, Bern, Fribourg, and Neuchâtel), Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), European Science Film Production (BioScience Network, Lausanne) and The Catalyst (Swiss Federal Institute of Arts and Sciences & Technology (EAWAG), Science Film Academy)	For example, Swiss Academy of Sciences SCNAT (2017)
	Nonintensive	Scientists, filmmakers and artists produce short films	Yes, but with enough time	Yes	4 days distributed over 2-3 months	Mainly PhD and postdoctoral students			2018		
Scientists are not taught the basics of filmmaking			Yes, but with limited resources and time	Yes	3 days intensive			1	2016		

These scientists produce films that can be used to publicize their research, present theses, or as video abstracts for submitting with their publications to publishers such as Elsevier, Cell Press, Wiley, and Taylor & Francis, all of whom now encourage the submission of video abstracts.

Since the early days of cinema, filmmaking has evolved from a subordinate role vis-à-vis science to a position as an equal partner in the production of knowledge (Gouyon, 2015). Today, the new generation of scientists-as-filmmakers—albeit nonprofessional—will have an important role in the coming era of science communication to peers and the general public.

Nevertheless, there are still many obstacles to be overcome in the task of promoting a new generation of scientists-as-filmmakers and the consolidating of the science filmmaking courses that will teach them. A general consensus exists within the scientific community that outreach training is needed (Leshner, 2007) and that training in science filmmaking should be a top priority. Films should become more widely accepted as legitimate contributions to scientific journals (e.g., *Journal of Visualized Experiments*; Assadi & Gasparyan, 2015). Scientists-as-filmmakers will surely benefit from the organization of science film festivals in which they can screen their films and discuss their results with their peers and other scientists-as-filmmakers (Bultitude, McDonald, & Custead, 2011; Hoffman, 2008). The boom in science films and filmmaking courses encouraged me to set up and direct a major science film festival (Global Science Film Festival) as a platform for this new generation of scientists-as-filmmakers emerging in Switzerland and for the screening of their films and promoting discussions with professional filmmakers and the public. The Global Science Film Festival screens films in three categories: two categories for professional filmmakers (feature-length and short films) and one category exclusively for the films produced by this new generation of scientists-as-filmmakers.

Author's Note

Some of the science filmmaking courses offered in Switzerland may not be included in my study simply because I was not aware of them. Many universities and research institutes advertise their educational courses only internally, and so they are difficult to find by searching on the Internet. However, I believe that my article is representative enough of the courses taught in Switzerland over the past 5 years. I note that the term *scientists-as-filmmakers* was first used by Agrawal (2001).


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Author Biography

Samer Angelone is a filmmaker and scientist and holds a PhD in biology and master's degrees in film studies and film direction. He teaches filmmaking courses at numerous universities, research institutes, and film festivals (e.g., Locarno Festival and Visions du Réel Film Festival). He is the founder of the Global Science Film Festival (www.sciencefilm.ch) and has directed several fiction and documentary films (www.vimeo.com/samerangelone). He sits on the jury at prestigious film festivals (e.g., Cinemambiente Film Festival, Planet in Focus).

Chapter 2

Filmmaking courses for scientists help promote richer alternatives to chronological narratives

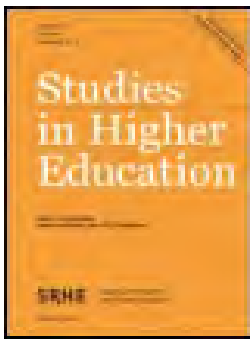
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Photography from the educational film that we prepared for the narrative analyses ‘Poacher Detectors Dogs’, Kenya 2015






Filmmaking courses for scientists help promote richer alternatives to chronological narratives

Samer Angelone, Ramón C. Soriguer & Ana Melendo

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Filmmaking courses for scientists help promote richer alternatives to chronological narratives

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ABSTRACT

Scientists have the tendency to communicate their scientific accounts using linearly structured narratives (Introduction, Methods, Results and Discussion; IMRAD). Likewise, the linear narrative is dominant – due to force of habit – when scientists prepare films about their research. Yet, this does not necessarily have to be the case for the new generation of *scientists-as-filmmakers*, who is trained to appreciate and apply alternative narrative structures. We evaluated the narrative structures of scientists from Swiss universities and research centres. Before the filmmaking courses, 94.1% of participants would use the linear narrative structure in their films, while the remaining participants would use one of the other alternative narrative types. However, after participating in the filmmaking courses, the number of potential users of the linear narrative fell almost 11-fold, and this type of narrative became the least popular. By contrast, after the courses the *before-climax-backwards* narrative experienced a 79-fold increase in potential use. The *parallel*, *frame* and *end-backwards* narratives had seven-, six- and four-fold increases, respectively. The filmmaking courses also dramatically increased the number of types of narratives that participants would consider using. Filmmaking courses for scientists help *scientists-as-filmmakers* make a clean break from linear narrative structures in favour of other more varied structures.


KEYWORDS

Chronological narrative; non-chronological narrative; linear narrative; alternative narrative; *end-backwards* narrative; *before-climax-backwards* narrative; *frame* narrative; *parallel* narrative; Switzerland

Introduction

Science films are an excellent tool for communicating science to peers and the general public (Career Feature 2018; CUNY TV PBS 2016; National Academy of Sciences 2008). In recent decades, the demand for science films has increased hugely. However, this expanding demand cannot be entirely satisfied by professional filmmakers. Thus, universities and scientific institutes are now encouraging their scientists and students to produce their own films by setting up accredited filmmaking courses as part of their science communication programmes. This has given birth to a new generation of *scientists-as-filmmakers*, that is, 'scientists that assimilate filmmaking as part of their academic preparation, albeit not in a professional way' (Angelone 2019). Besides, learning filmmaking has a direct application for science films and can also help improve oral and written scientific communications (Dahlstrom 2014; Jones and Crow 2017; Martinez-Conde and Macknik 2017). Nevertheless, it is not

CONTACT Samer Angelone  samer.angelone@gmail.com  Faculty of Philosophy and Letters, Cordoba University, Plaza del Cardenal Salazar, s/n, Cordoba 14071, Spain; Institute of Evolutionary Biology and Environmental Studies (IEU), University of Zurich, Winterthurerstrasse 190, Zürich 8057, Switzerland; Global Science Film Festival, Imfeldstrasse 25, Zurich 8037, Switzerland

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clear how these courses will affect the films produced by the next generation of *scientists-as-filmmakers*, e.g. the narrative structures of the documentary films.

Although 'narrative' and 'story' are often used as synonyms in informal contexts, these two concepts are somewhat different in meaning. A story refers to the content, that is, the events (actions) and existences (settings and characters) that are being related, while narrative is more concerned about the how this content – via points of view, narrative voices and plots – is presented to readers/audience (Chatman 1980). Two temporal sequences combine in every narrative: (i) chronological time in which events unfold (story time) and (ii) narrative time, that is, the time it takes for events to be told (Genette 1983). A narrative is 'narrated', while events in a story 'happen' (Kim et al. 2018). Jean-Luc Godard summed up the differences between story and narrative as follows: 'A story should have a beginning, a middle and an end, but not necessarily in that order' (Sterritt 1999). The 'not necessarily in that order' is the narrative.

A non-linear narrative is a storytelling device that does not portray the events of a story in chronological order; this may mean a reverse order, going back and forth between past and future events, or even switching between one parallel plot and another (Kim et al. 2018). In the non-linear narrative the relationship between events does not follow the original cause–effect sequence, the purpose of which may be to heighten the mystery and tension. A narrative can withhold information, which is revealed at a later point. Another possibility is to start in the middle of the story or even at the end, and then travel back to the same point in order to capture the audience's attention immediately without any need for detailed descriptions (Aarseth 2012; Chatman 1980). Patterns of non-linear narratives and their effects on audiences, as well as how audiences perceive such story lines, have been well studied in many media contexts (Genette 1983; Propp 2010). Appreciating and applying non-linear narratives is not necessarily an intuitive task due to the often complex temporal disruptions in event sequences and the non-explicit recording of the temporal order of the story (Kim et al. 2018).

Scientists tend to communicate their scientific stories using linearly (chronologically) structured narratives based on the classical main sections of scientific manuscripts: Introduction, Methods, Results and Discussion (IMRAD) (Sollaci and Pereira 2004). Indeed, even the sub-sections are usually chronologically presented (e.g. in Methods fieldwork comes before laboratory work) and, given the nature of scientific publications and presentations, it is understandable that this tendency is closely adhered to in films. Consequently, it comes as no surprise that linear narratives are dominant – due to force of habit – when scientists make films and that the alternative types of narratives that film as a media offers are rarely taken into account.

The aim of this paper is to understand and predict how filmmaking courses will affect the narrative structures used in future documentary films produced by the new generation of *scientists-as-filmmakers*.

Methods

Filmmaking courses' organisers, trainers, and participants

There is a general consensus in Swiss universities and scientific institutes that scientific outreach programmes are needed, mainly to bridge the gap between science and society (Leshner 2003). Hence Swiss universities and scientific institutes established and funded numerous outreach programmes, among them filmmaking courses (Angelone 2019).

Authors of this paper were responsible of establishing the curricula and teaching these courses. Changing narrative structures was one of the designated desired outcomes of these filmmaking courses, through teaching participants alternative narrative structures.

Our study included 102 scientists (mainly PhD and post-doctoral students) from nine Swiss universities and research centres: seven universities (Zurich, Geneva, Lausanne, Fribourg, Neuchatel, Basel and ETH Zurich) and two research centres (Swiss Federal Institute for Forest, Snow & Landscape Research WSL, and Swiss Federal Institute of Aquatic Science & Technology EAWAG). The organisers

worked together on common programmes in the preparation of some of filmmaking courses and, for example, Life Science Zurich (which includes Zurich University and ETH Zurich) worked in close collaboration with the Conférence des Universités de Suisse Occidentale (which includes the universities of Geneva, Lausanne, Bern, Fribourg and Neuchatel). The participants, of whom 73 were women and 29 men, had different scientific backgrounds.

Course description

Our study analysed a wide variety of the filmmaking courses taught in Swiss universities and research centres in 2015–2018.

- 1 **Storytelling and storyboarding science:** these are two–four-day courses. The main aim of these theoretically oriented courses is to teach scientists how to borrow narrative attributes and techniques of storytelling from filmmakers and apply them in their communications (i.e. in their abstracts, presentations and scientific papers). Scientists also learn how to watch and analyse films from a technical standpoint, and how to convey the ideas behind scientific narratives to professional filmmakers. Attending film festivals (e.g. the Locarno Film Festival and Global Science Film Festival) sometimes forms part of these courses and allows participants to analyse screened films and have professional discussions with filmmakers (e.g. Science Film Academy 2017).
- 2 **Filmmaking for scientists:** these are more technically oriented courses, where scientists learn how to prepare their own films. During two–five-day courses, participants are taught mainly how to work with camera, lighting and sound equipment. They are also taught the basic of storytelling, script, storyboarding and editing techniques. Producing short films by the end of the courses is usually an essential part of these courses, especially the longer ones. Produced films are usually directly related to the scientific research of the participants (e.g. Life Science Zurich, Zurich University and ETH Zurich 2015).
- 3 **Science filmmaking marathon:** in these usually competitive, four-day courses, scientists and filmmakers work in small groups to produce films. Shortly before these courses, scientists are introduced to basic filmmaking techniques. The resulting films are not necessary related to the scientific research of the participants but are scientific in content in a general sense. At the end of the marathon, the resulting films are usually screened to the public and a special jury (e.g. Swiss Academy of Sciences SCNAT 2017).

For more details see [Table 1](#).

Non-linear narrative structures

The participants in all courses were taught to recognise and apply four alternative narrative structures that we believe are appropriate for simple science films:

1. Two *in media res* structures

In media res means that the film begins in the middle of the storyline rather than at the beginning. Two different *in media res* structures were taught; namely, starting a story in the middle (*before climax-backwards*) or even at the end (*end-backwards*), and then doubling back to the same point. This technique aims to grab the audience's attention without any detailed introduction by placing the audience immediately right in the heart of the action. A simple example of an *end-backwards* structure involves introducing the main results and then moving backwards to the IMRAD. A successful *before-climax-backwards* structure can be achieved by presenting part of the results (not the main results) at the beginning, and by then moving back in time to the IMRAD.

II. *Parallel* and *frame* structures

**Table 1.** Details of the science filmmaking courses included in the analyses of the narrative structures.

Course	Course Content		Duration (days)	Participants	Number of Participants	Credit Points	Date	Organizers and Hosts	References
	Theory	Practice							
Filmmaking for Scientists	Mainly, how to work with camera, lighting and sound equipment. As well, storytelling, script, storyboarding and editing techniques	Filming short films, reports, interviews or video-abstracts. Films are related to the participants' own scientific research	two–five	PhD students but master's and post-doctorate students are also considered	10–15	one–two	2015–2018	Conférence des Universités de Suisse Occidentale (Universities of Geneva, Lausanne, Bern, Fribourg and Neuchatel), Life Science Zurich (ETH and Zurich University) and Zurich-Basel Plant Science Center (ETH, Zurich University and Basel University)	e.g. Life Science Zurich Zurich University and ETH Zurich (2015).
Science Filmmaking Marathon	The basics of filmmaking techniques (storytelling, script, storyboarding and editing techniques, cameras and lighting and sound equipment)	Producing short films. Films are not necessary related to participants' own scientific research but are about science in general	four	PhD students but master's and post-doctorate students, and researchers are also considered. Filmmakers also participate in this workshop	25–40	two	2017	Swiss Academy of Sciences, Life Science Zurich (ETH and Zurich University), Conférence des Universités de Suisse Occidentale (Universities of Geneva, Lausanne, Bern, Fribourg and Neuchatel), Swiss Federal Institute for Forest, Snow & Landscape Research (WSL), Swiss Federal Institute of Aquatic Science & Technology (EAWAG) and Science Film Academy	e.g. Science Film Academy (2017).
Storytelling and Storyboarding Science	Storytelling, script and storyboarding techniques. How to communicate with professional filmmakers. How to borrow narrative attributes and techniques of storytelling from filmmakers	Re-writing scientific abstracts, biographies and scientific papers by borrowing narrative attributes and techniques of storytelling from filmmakers. Attending film festivals to watch and analyse screened films, and to talk with filmmakers about their stories and storyboards	two–four	Very wide range: undergraduate, master's, PhD and postdoctorate students; associate researchers and lecturers	10–50	one–two	2017–2018	Swiss Academy of Sciences, Didactica (ETH and Zurich University), Department of Evolutionary Biology and Environmental Studies (Zurich University), Locarno Film Festival and Global Science Film Festival	e.g. Swiss Academy of Sciences SCNAT (2017).

Parallel and *frame* stories use narrative structures that rely heavily on the role of the narrator to convey layers of meaning. A *parallel* structure refers to two distinctly different, yet closely related storylines that occur simultaneously. Similarly, a *frame* structure – also known as an embedded narrative – consists of many smaller stories within the context or timeframe of a larger story. Each of the narratives within the timeframe can usually stand individually but have more meaning when analysed alongside the larger overall story. Simple examples of the *parallel* structure include the simultaneous presentation of two distinctly different yet closely related storylines (e.g. fieldwork and laboratory work), even if they took place at different moments in time. In the case of *frame*, different studies can be presented within the context of a larger one (e.g. different chapters within the context of a PhD thesis or different research focuses within the context of a single research group).

To avoid possible bias in the design and analyses of our study:

- The same person taught all courses.
- Even when filmmaking courses had different aims (learning theoretical or practical parts of filmmaking, producing films and/or borrowing narrative attributes and techniques of storytelling from filmmakers), duration (two–five days) and target audiences, the same didactical materials were used to teach participants how to recognise and apply narrative structures to film.

Questionnaire

Before the filmmaking courses began, the technical descriptions of different narrative structures (*before climax-backwards*, *end-backwards*, *parallel* and *frame*) were unfamiliar to participants. Even if participants did recognise certain narrative structures, they were unable to give them a name, and hence it was not possible to run the questionnaire at the beginning of the courses. To solve this problem, participants were asked at the beginning of the courses to think and write down all details (story, storyboard and the structure of the plot) about the films that they would like to make in the future. After having decided upon the details of the films (including the narrative structure, even if they were unaware of this technical terms) that they would like to film, participants were taught the four above-mentioned alternative narrative structures. Then, participants responded to a questionnaire about the narrative structures that they would have used before beginning the filmmaking courses and the ones that they would use after attending the courses. Each participant could choose more than one narrative structure (see the template of the questionnaire in Table S1).

Statistical analyses

To compare between the frequencies of the chosen narrative structures before and after the courses, a frequency analysis χ^2 (Pearson's Chi-squared test X-squared) was used. Fisher's Exact Test for Count Data was employed to compare the frequencies of the chosen narrative structures for female and male participants, and to compare the results obtained from the different courses (filmmaking for scientist, storytelling and storyboarding science, and science filmmaking marathon). Non-parametric statistical tests (Wilcoxon signed rank test with continuity correction and Spearman's rank correlation coefficient) were applied to compare the number of types of narratives that would have been used before and after the filmmaking courses. All analyses were carried out using R Package V.2.15.1 (R Development Core Team 2008) (Figures 1–3).

Results

Participants' preferred narrative structures changed after attending the filmmaking courses (Pearson's Chi-squared test X-squared = 154.5, df = 4, *p*-value < .001). Before the filmmaking courses,

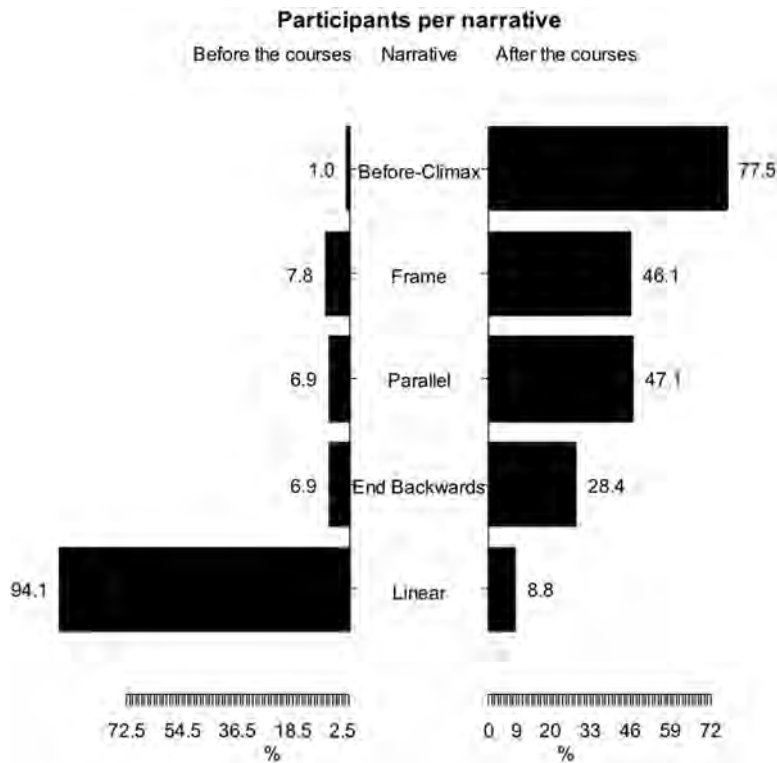


Figure 1. Changes in the choice of the narrative structures before and after the filmmaking courses.

94.1% of participants said they would use the linear narrative structure in their films and only a very few said they would use one of the alternative narratives, namely, *end-backwards* (6.9%), *parallel* (6.9%), *frame* (7.8%) and *before-climax-backwards* (1%). However, after the filmmaking courses, the number of the possible users of the linear narrative fell almost eleven-fold (only 8.8% of the scientists said they would use it) and this narrative became the least popular. By contrast, after the courses 77.5% of participants said they would use the *before-climax-backwards* narrative, a seventy-nine-fold increase, while 47.1% would use the *parallel* narrative (about a seven-fold increase). In all, after the course 46.1% of participants said they would use the *frame* narrative (six-fold increase). The *end-backwards* narrative increased four-fold, and would be used by 28.4% of the participants.

The filmmaking courses not only affected the choices of the narrative structures (a move from linear to alternative) but also increased the number of types of narratives that participants said they would consider using (Wilcoxon signed rank test with continuity correction $V = 77.5$, p -value $< .001$; Spearman's rank correlation coefficient 0.42, p -value $< .001$). Before the courses, the majority of participants (84.3%) said they would use only one narrative structure and only 14.7% and 1% said they would use two or three different structures, respectively. However, after attending the courses, the number of participants who said they would use only one narrative structure fell to 44.6%, while the number of participants who would use two or three structures increased to 20.8% and 19.8%, respectively. Indeed, 12.9% and 2%, respectively, of participants said they might even use as many as four or five different narrative structures. There were no differences in the obtained results between the different courses (filmmaking for scientist, storytelling and storyboarding science, and science filmmaking marathon).

In all, 72% of the scientists who attended the filmmaking courses were female; there were no statistical differences between female and male scientists regarding their choices of the documentary

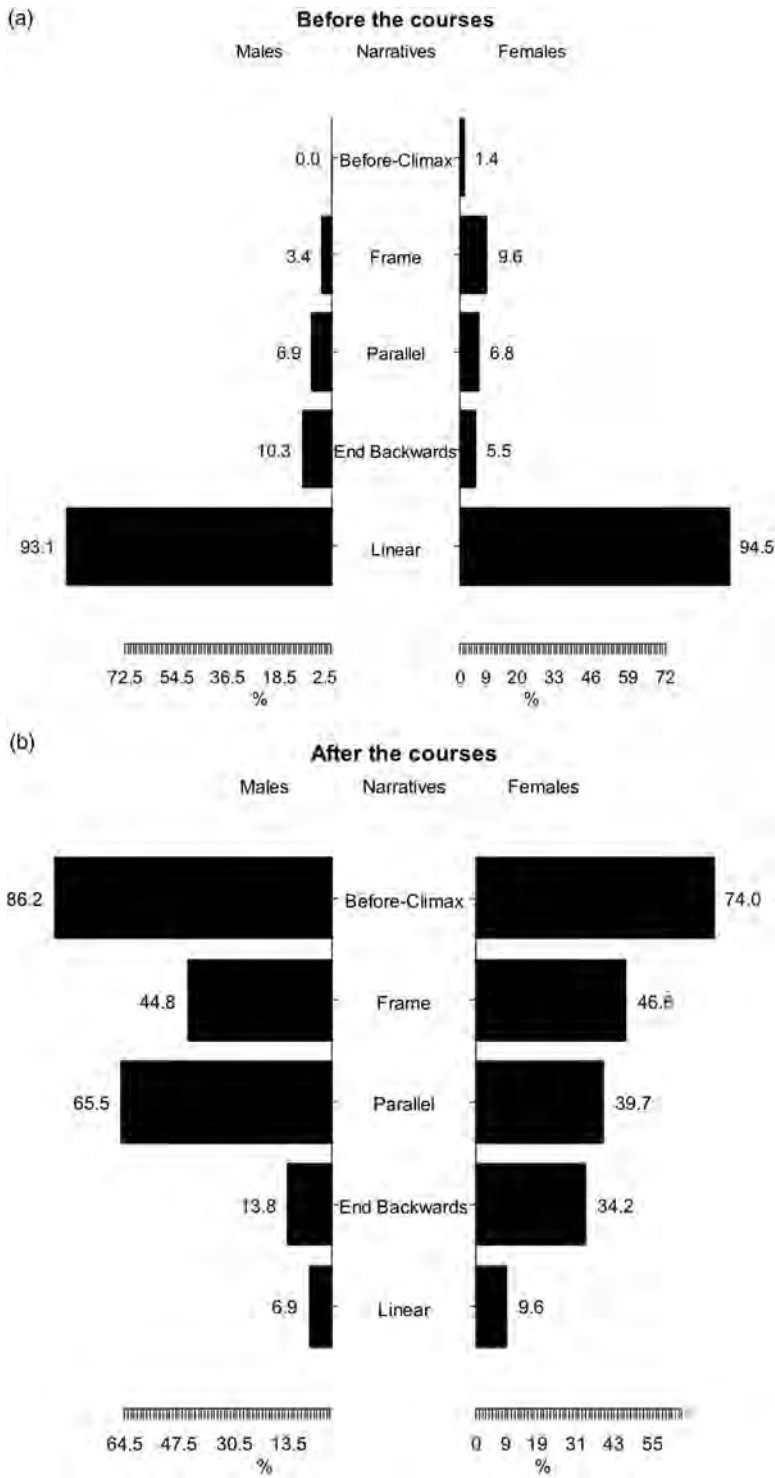


Figure 2. Narrative structures chosen by female and male scientists before (A) and after (B) the filmmaking courses.

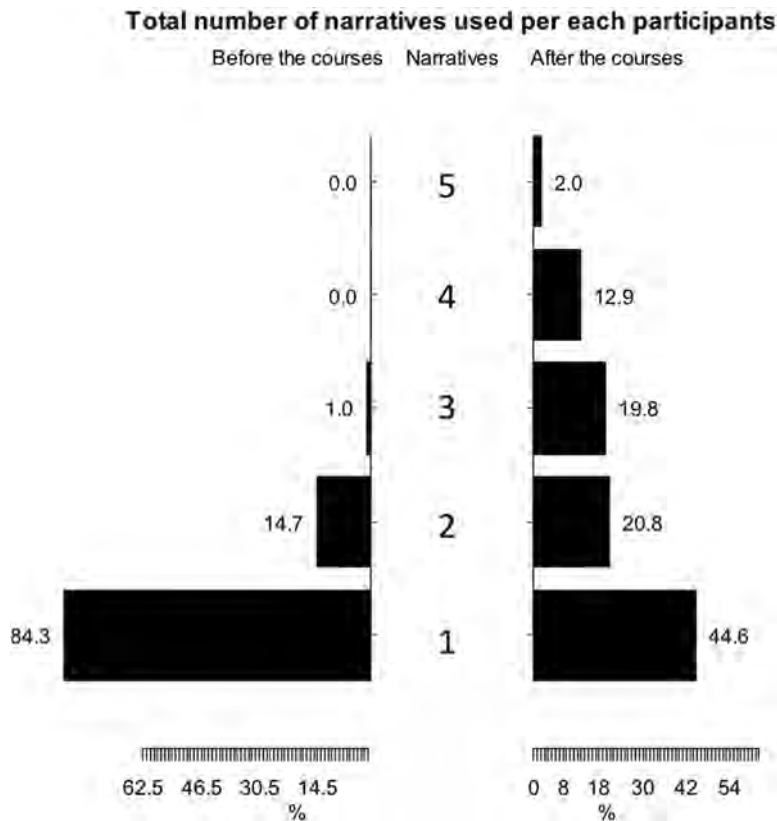


Figure 3. Changes in the number of the narrative structures chosen before and after the filmmaking courses.

modes they would use either before (Fisher's Exact Test for Count Data, p -value = .264) or after (Fisher's Exact Test for Count Data, p -value = .1787) the filmmaking courses.

Conclusion & discussion

When they have no filmmaking background, the linear narrative structure is the dominant intuitive choice for scientists. This mode possesses the same traits and conventions as those used in scientific narratives (e.g. scientific papers and presentations) (Olson 2015). The dominance of this structure can be attributed to the lack of knowledge of the possibilities that alternative narrative structures offer. Only a very few scientists said they would opt for a different type of narrative structure (even if they did not know the technical names of these alternatives). The differences between the alternative structures should have been intuitively obvious in the films they watched. The decision to use alternative narrative structures (before attending the courses) could be due to the type of scientific research participants were working on; however, our questionnaire did not include details about the purpose of the films or the targeted audience. For the same reason, due to this lack of knowledge, the number of preferred narrative structures was limited.

After attending the filmmaking courses the preferred narrative structure changed dramatically from lineal to alternative. Indeed, only a very few participants continued to prefer the lineal narrative. Most of the participants chose the *before-climax-backwards*. A large number of participants also opted for the *two in media res frame* or *parallel* structures. The *end-backwards* was also more often considered than before the filmmaking courses but was clearly less favoured than the other structures.

The shift from linear to alternative structures and the increase in the number of preferred structures could be attributed to participants' beliefs that they would tell better stories using the new structures, or simply could be due to the participants' curiosity regarding the narrative structures described during the course.

More female than male scientists participated in the filmmaking courses. Gender bias in science and art is an on-going debate and some authors argue that art education is female-stereotyped (Dalton 2001; Wikberg 2013).

Our results could be affected by the nature of the scientific background of the participant scientists and/or their targeted audiences. Neither factor was taken into account in our study.

There were no differences in the obtained results between courses, which was to be expected since the same didactical materials explaining the narrative structures were used in all the filmmaking courses. Less extensive courses are often just as effective as longer ones if the aim is only to learn how to recognise and apply alternative narrative structures; however, this was not the only aim of these science filmmaking courses.

We believe in the replicability of this study, since the studied narrative structures could be universally used in science films. Notwithstanding, the results could be affected by the experiences and training methods of the teacher and the chosen didactical materials.

This study highlights the importance of the filmmaking courses that universities and scientific institutes worldwide offer their students and scientists as a means of encouraging them to produce their own films. These courses should teach alternative narrative structures for scientific stories to the new generation of *scientists-as-filmmakers* and offer creative alternatives to linear narrative structures, thereby enriching the range of techniques used for portraying scientific insights.

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No potential conflict of interest was reported by the authors.

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Chapter 3

Modes of documentary films produced by the future generation of ‘*scientists-as-filmmakers*’

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Photography from ‘Storytelling Science’ at Locarno Film Festival 2018



Modes of documentary films produced by the future generation of 'scientists-as-filmmakers'

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Modes of documentary films produced by the future generation of 'scientists-as-filmmakers'

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ABSTRACT

Six documentary modes are recognised: poetic, expository, observational, participatory, reflexive and performative. Scientists untrained in filmmaking most often choose the expository mode since it possesses the same traits and conventions as used in most scientific narratives. Yet, this need not be the case given that a new generation of 'scientists-as-filmmakers', can be taught to appreciate and apply other documentary modes. In this study, we surveyed the possible documentary modes that scientists from nine Swiss universities and research centres would use, both before and after studying filmmaking courses. As expected, before the start of the courses, the majority of the participants (83.33%) said they would use the expository mode, while 27.45% said they would use the observational mode. However, after attending the filmmaking courses, the number of participants interested in the expository mode fell almost by half, while the number of participants who said they would use the observational mode almost doubled. Unexpectedly, after the course the most chosen mode was the poetic (70.58%), and there was also fair amount of interest in the participatory (38.23%) and reflexive (17.64%) modes. The films produced in the future by the generation of 'scientists-as-filmmakers' will contain a much greater variety of documentary modes.

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Introduction

Communicating science to the lay public is widely recognised to be the responsibility of scientists. General consensus exists within the scientific community that scientific outreach training is needed to restore the connection between science and society (Leshner, 2003). Outreach training should not focus simply on increasing public understanding of science since the problem is not merely one of a lack of scientific comprehension; rather, the issue is more about public engagement than public understanding of science (Leshner, 2007; Lunetta & Dekkers, 1982; Vesterinen, Tolppanen, & Aksela, 2016). Hence, outreach programmes need to be broadened. Science films should be one of the top priorities for outreach training (Angelone, 2019; Lesen, Rogan, & Blum, 2016) since films, which grab people's attention in a completely different way to traditional articles in journals (De Valck, Rokka, & Hietanen, 2009), are excellent tools for communicating science to peers and the general public (Career Feature Nature, 2018). An easy option would be to delegate the task of creating science films to a handful of professional filmmakers. However, this is not a practical proposal given the huge demand for such films and the breadth of topics and the intensity of effort required. To

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satisfy the demand for science films, universities and scientific institutes are now teaching their scientists and students how to produce their own science films by setting up accredited filmmaking courses that form part of science communication programmes. This has engendered a new generation of ‘scientists-as-filmmakers’ who ‘assimilate filmmaking as part of their academic preparation, albeit not in a professional way’ (Angelone, 2019). An appreciation of filmmaking has a direct application in science films and also helps improve oral and written science communications (Jones Michael & Anderson Crow, 2017; Martinez-Conde & Macknik, 2017; Olson, 2015).

Outreach programmes in science filmmaking should include training scientists (the new generation of ‘scientists-as-filmmakers’) to appreciate different types of documentary modes and how they can be employed for communicating science to peers and the general public.

In his book *Introduction to Documentary*, the documentary theorist, Nichols (2001) distinguished and discussed six documentary modes based on particular traits and conventions (poetic, expository, observational, participatory, reflexive and performative) used by documentary makers either consciously or simply because they represent filmmakers’ chosen way of telling their stories and sharing their knowledge. Understanding documentary modes, their traits and conventions are essential not just for teaching filmmakers how to analyse documentaries but also for helping them to create their own documentaries.

Expository mode

The ‘voice of God’ mode makes use of narrations that employ scripted (oral or written) commentaries illustrating or simply accompanying footage. This is the most familiar mode – especially to scientists – since it is commonly used in nature and TV documentaries, and aims to educate its audience and explain its subject matter as a documentary essay. These films focus more on facts, objective information and evidence than on evocation of emotions (e.g. *Africa* 2013 by BBC Natural History Unit, and *March of the Penguins* 2005 by Luc Jacquet).

Observational mode

The fly-on-the-wall documentary mode or *cinema verité* views the truth without comment or involvement. Nothing is staged and what we see is completely natural. This mode implies that the filmmakers, equipment and crew are invisible and are unheeded by the filmed subjects. This was made possible by advances in technology during the 1960s and 1970s as sound and camera equipment became easier to use and manoeuvre. This begs the question: how natural can someone be in the presence of the cameras, filmmakers and crew? However, this issue does not necessarily detract from the observational mode itself (e.g. *Salesman* 1969 by Albert Maysles, David Maysles, and Charlotte Zwerin, and *Armadillo* 2011 by Janus Metz Pedersen).

Participatory documentaries

This mode reflects documentaries in which ‘the encounter between filmmaker and subject is recorded and the filmmaker actively engages with the situation they are documenting’ as Nichols explained (2001). This is ‘investigative filmmaking’, i.e. a question is raised or a controversial issue explored and the filmmaker objectively attempts to show on film the audience the progress of their chosen topic. The filmmakers become an integral part of the film, even though they are supposed to be telling a story objectively (*Icarus* 2017 by Bryan Fogel, *Bowling for Columbine* 2002 by Michael Moore, *The Green Lie* 2018 by Werner Boote).

Reflexive documentaries

The reflexive documentary mode stimulates audiences to ‘question the authenticity of documentary in general’. Spectators acknowledge the way a documentary is constructed (the use of the camera,

audio and even editing) and in some cases are as interested in how the film is constructed as the actual content (e.g. *The Man With A Movie Camera* 1929 by Dziga Vertov and *Driving Me Crazy* 1988 by Nick Broomfield).

Poetic mode

The poetic mode ‘moves away from the ‘objective’ reality of a given situation or people, to grasp at an ‘inner truth’ that can only be grasped by poetical manipulation’, as Nichols (2001) stated. The structure of the film is not based on a linear continuity but, rather, arranges shots based on associations, tone and rhythm. The poetic mode, usually associated with avant-garde filmmaking, is subjective and an abstract representation of reality. Special emphasis is placed on visual imagery the film is more reliant on colour, tones, sounds and moods (e.g. *The House Is Black* 1962 by Forough Farrokhzad, and *Samsara* 2011 by Ron Fricke).

Performative documentaries

The performative mode is regarded as the direct opposite of the observational mode. The filmmaker tends to be passionately involved and hence performative documentaries are usually subjective. The performative mode is easily confused with the participatory mode, the difference lying in the fact that, whereas the participatory mode links the filmmaker to the story and attempts to construct truths that should be self-evident to anyone, the performative mode links the filmmaker to the story and constructs subjective truths that are only significant to the filmmaker. Rather than setting out to find the truth, the performative mode shows just one perspective of the truth (*Super Size Me* 2004 by Morgan Spurlock, *Tongues United* 1989 Marlon Riggs).

Documentary modes are not mutually exclusive and the same documentary may make use of one or more of the six above-mentioned modes. There is often significant overlap within one documentary (Nichols, 1994), and even some argue that Nichols’ concept of modes could also be applicable at a micro level (scene-by-scene), (Natusch & Hawkins, 2014). ‘The characteristics of a given mode function as a dominant in a given film ... but they do not dictate or determine every aspect of its organization’, highlighted Nichols (2001).

The main reasons for teaching documentary modes to the new generation of ‘scientists-as-filmmakers’ can be divided into two categories: I. effective communication and II. quality and style.

I. Effective communication

Knowledge of documentary modes is fundamental for understanding the language of documentary films in general and so also of science documentary films. ‘Scientists-as-filmmakers’ in particular and film directors in general require a keen awareness of documentary modes if they are to produce compelling films using the appropriate mode for the message they want to convey and for the audience they are targeting. These documentary modes act as a skeletal framework that ‘scientists-as-filmmakers’ can flesh out according to their creative dispositions.

Through force of habit, scientists untrained in filmmaking typically choose the expository mode (Boon, 2014; Sternberg, 2010) since it possesses the same traits and conventions as are present in most scientific narratives (e.g. scientific papers and presentations) (Sollaci & Pereira, 2004; Williams, 2015). Hence, the new generation of ‘scientists-as-filmmakers’ ought to be encouraged to break free from the dominance of the expository mode (disseminating information or attempting to persuade) and embrace more diverse documentary modes that better fit the desired personal reactions/responses to the films they produce. An option is to follow the AEIOU vowel analogy: Awareness, Enjoyment, Interest, Opinion-forming, and Understanding (Burns, O’Connor, & Stockmayer, 2003). Even so, more studies of how the documentary mode can imbue science films with different meanings are still needed (Little, 2007; Mellor, 2018). For example, the expository mode is especially

appropriate for Awareness and Understanding responses. This mode is relatively straightforward – a ‘show and tell’ structure guiding viewers through the documentary – and is essentially didactic in nature (Boon, 2014; Sternberg, 2010). The observational documentary mode generates above all Awareness and Opinion-forming responses as it aims to adopt an apparently ‘neutral’ stance that distances itself from its subject matter, and simply captures reality as it unfolds (Carta, 2015). The Enjoyment and Interest responses are linked to the poetic mode, which captures moods and feelings and does not attempt to develop any explicit arguments about a subject. This opens the way for alternative forms of knowledge differing from the straightforward transfer of knowledge (Frankham, 2013). The participatory and reflexive modes engender Interest and Opinion-Forming responses. Participatory and reflexive documentaries both highlight the filmmaker’s personal involvement in a film and how it subsequently modifies what happens therein. The participatory mode engages directly with individuals without reverting to mainstream interview styles (Villanueva Baselga, 2015). The reflexive documentary is the most self-aware mode and shows audiences how other documentary modes claim to construct the ‘truth’ by highlighting the artificial nature of film-making (Goodarzi & Tamjidi, 2014). The Performative mode leads to the Enjoyment and Opinion-Forming responses and underscores the links between a subjective knowledge/understanding of the world and more general considerations. In this mode, filmmakers and their subjects create an active documentary via the performance of certain actions (Little, 2007). ‘Scientists-as-filmmakers’ may aim to provoke with their films one or more of the AEIOU responses in viewers, who will include students, members of the public, and representatives from industry, business and government, as well as spectators from the world of science and scientific mediation (Burns et al., 2003).

II. Quality and style

‘Among the many limitations of the deficit model of science communication is its inability to account for the qualities of communication products that arise from creative decisions about form and style.’ (Mellor, 2018). Quality is a crucial issue and an important challenge for contemporary science communication, and style is key when addressing these challenges (Bucchi, 2013). Bucchi stated that ‘Public communication of science should now be mature enough to pass from a “heroic phase”, in which “everything goes” for the sake of communicating science, to a phase in which quality is the central concern for all parties involved.’ Bucchi (2013) advocated a wider-ranging vision of science communication that would provide a vision of science as a central part of the contemporary culture of ‘aesthetics of science communication’. The concept of style enables us to tackle the issue of quality in science communication without imposing either uniformity or any ‘best’ or ‘most appropriate’, ‘one-size-fits-all’ model of science/public interaction. Hence, it is important that the documentary modes used by the new generation of ‘scientists-as-filmmakers’ are as diverse as possible.

Style is another important issue taken into account by science film festivals. As a result of the great increase in demand for science films, science film festivals have burgeoned in recent decades (Bultitude, McDonald, & Custead, 2011; e.g. Bristol Science Film Festival <https://brissciffilm.wordpress.com>; Science Film Festival from Goethe Institute www.goethe.de/ins/th/prj/wif/fes/enindex.htm; Imagine Science Films <http://imaginesciencefilms.org>; Festival International du Film Scientifique Pariscience <https://pariscience.fr>; and Academia Film Olomouc <https://afo.cz>). Science film festivals are more than just simple platforms for circulating science films as they aim to ‘promote science literacy and awareness of contemporary scientific and technological issues through film’ (e.g. Science Film Festival from Goethe Institute) and ‘promote a high-level dialogue between scientists and filmmakers’ (e.g. Imagine Science Films Festival). Consequently, science film festivals are attractive platforms where the new generation of ‘scientists-as-filmmakers’ can screen their films. Yet, getting a film screened at a science film festival is not an easy task since thousands of films are submitted to these festivals and all have to face a rigorous selection process. Documentary modes are one of most important criteria for film selection at science film festivals (and documentary film festivals in

general) and festivals aim to screen films made using a great variety of modes (i.e. not just the expository mode). Science films have better chances of being screened in highly competitive science film festivals if they are filmed using one of the hitherto less-popular documentary modes.

To our knowledge, the educational outreach programmes in science films do not receive nearly as much scholar attention as other outreach programmes (e.g. Angelone, 2019; Angelone, Soriguer, & Melendo, 2019; Vennix, den Brok, & Taconis, 2018). It is not clear how these filmmaking courses for scientists will affect the documentaries produced by the new generation of *scientists-as-filmmakers* in the future and so the aim of this paper is to explore how filmmaking courses may be designed to broaden the use of documentary modes.

Methods

Organisers and participants

In 2015–2018 we studied the chosen documentary modes of 102 scientists (mainly PhD and post-doctoral students) participating in science filmmaking courses organised by seven Swiss universities (Zurich, Geneva, Lausanne, Fribourg, Neuchatel, Basel and ETH Zurich) and two research centres (Swiss Federal Institute for Forest, Snow & Landscape Research WSL and Swiss Federal Institute of Aquatic Science & Technology EAWAG). The scientists, of whom 73 were women and 29 men, came from a variety of scientific backgrounds.

Filmmaking courses for scientists

The analysed science filmmaking courses can be divided into three categories:

I. Theoretical-oriented courses; usually called ‘storytelling and storyboarding science’, with some variations in the exact title.

During 2–4-day courses, 10–50 scientists learn, above all, narrative attributes and techniques of storytelling applied by filmmakers and how to apply them in science communications (e.g. scientific papers, presentation to conferences and didactical material). Some of these courses included attendance at the Global Science Film Festival and Locarno Film Festival. Attending film festivals enables participants to analyse the screened films and talk with professional filmmakers (e.g. Science Film Academy, 2017).

II. Practical-oriented courses; usually called ‘filmmaking for scientists’, with some modifications in the title.

During 2–5 day courses, 10–15 scientists are taught the technical side of science filmmaking and learn how to work with camera, lighting and sound equipment. The theoretical part of storytelling, script, storyboarding and editing techniques is not regarded essential in this type of course. The practical part of these courses includes producing science films that are directly related to participants’ scientific research (e.g. Conférence des Universités de Suisse Occidentale, 2016).

III. Competitive-oriented courses; the so-called science filmmaking marathons.

Forty scientists and filmmakers work for four days in small groups to produce science films after having been taught the basic ideas of filmmaking at the beginning of the course. The aim of these competitive courses is not to produce films directly related to participants’ scientific research but, rather, to practice filmmaking by producing films that relate to science in general (e.g. Swiss Academy of Sciences SCNAT, 2017).

The authors of this paper were responsible for establishing the curricula, and teaching of these filmmaking courses. The modes of documentary films were taught during theoretical sessions on the first day of all courses. In these filmmaking courses, documentary modes have been introduced to broaden the participants' capacity of making relevant choices in the process of filmmaking.

Questionnaire

Before answering the questionnaire, participants were asked to think in detail about the films that they would like to make in the future. With a clear vision in mind, participants were then taught the six documentary modes (Nichols, 2001). Finally, participants answered the questionnaires regarding the documentary modes that they would have used before attending the filmmaking courses and the ones that they would use in light of the course content. Each participant could choose more than one documentary mode.

Statistical analyses

The frequency analysis χ^2 (Pearson's Chi-squared test *X*-squared) was used to compare the frequencies of the used narrative modes before and after the courses. Fisher's Exact Test for Count Data was applied to compare the frequencies of the narrative modes used by female and male participants. To compare the number of types of narrative modes chosen before and after the filmmaking courses, nonparametric statistical tests (Wilcoxon signed rank test with continuity correction and Spearman's rank correlation coefficient) were used. All analyses were carried out using R Package V.2.15.1 (R Development Core Team, 2008).

Results

Preferred modes differed before and after the workshops (*X*-squared = 95.499, *DF* = 4, *p*-value < 2.2e-16). As expected, before the filmmaking courses the majority of participants (83.33%) said they would have used the expository mode, while just 27.45% said they would have used the

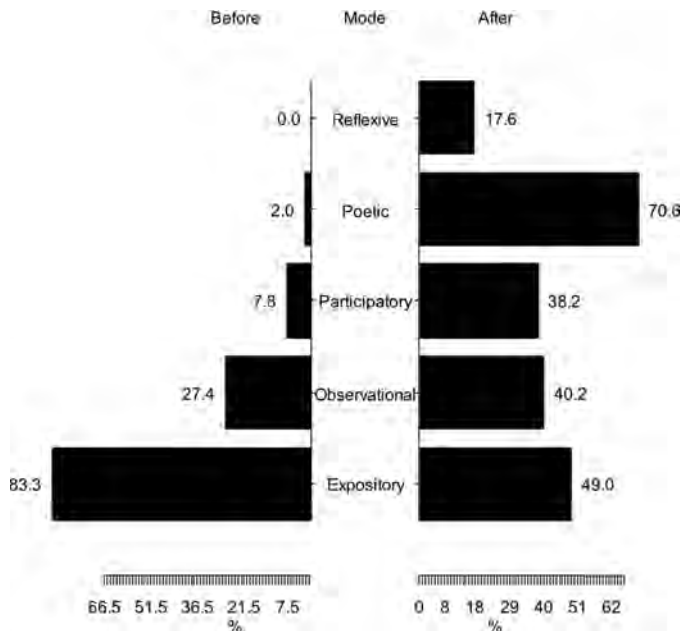


Figure 1. Changes in the choice of the 'possibly used' documentary modes before and after the filmmaking courses. After the courses only two participants opted for the performative mode (data not shown in the graphic).

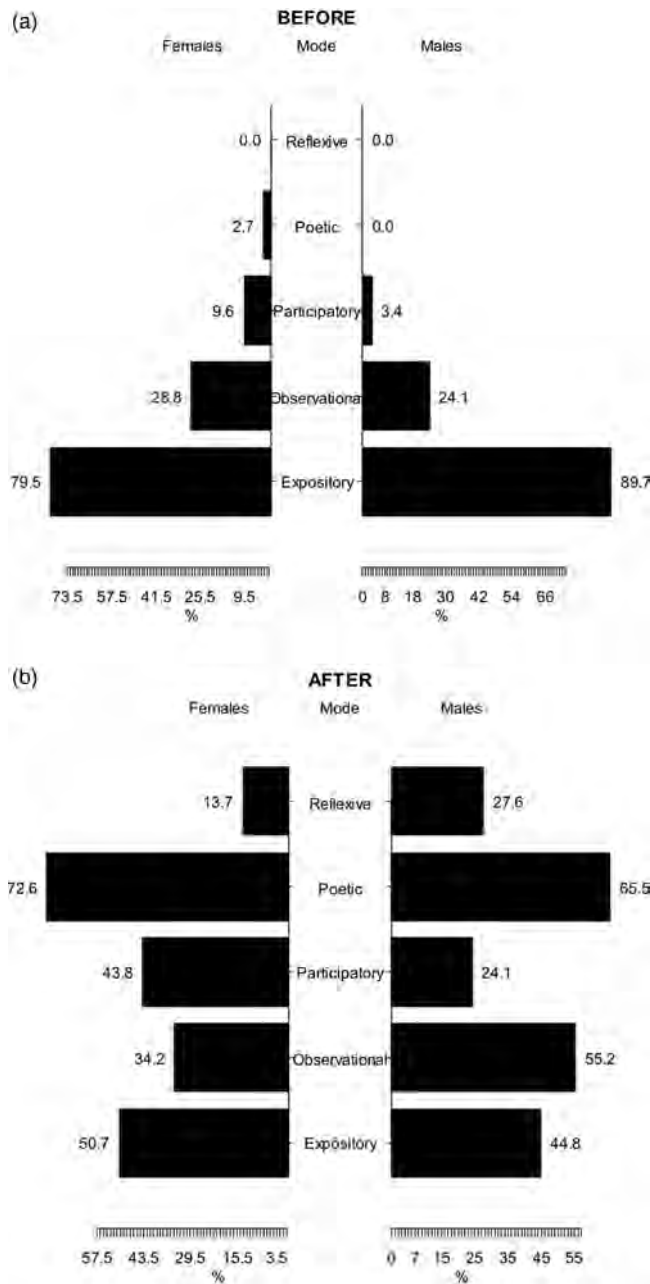


Figure 2. The documentary modes chosen by female and male scientists before (A) and after (B) the filmmaking courses.

observational mode. Only 7.84% and 1.96%, respectively, of participants said they would have used either the participatory or poetic modes. Before the filmmaking courses, no participants showed any interest in the performative mode. However, after attending the courses, the number of participants potentially interested in the expository mode fell almost by half (49.02%), while the number of participants who said they would use the observational mode almost doubled (40.19%). Unexpectedly, the mode most often chosen by scientists after attending the filmmaking courses was the poetic mode (70.58%), and there was also much more interest in the

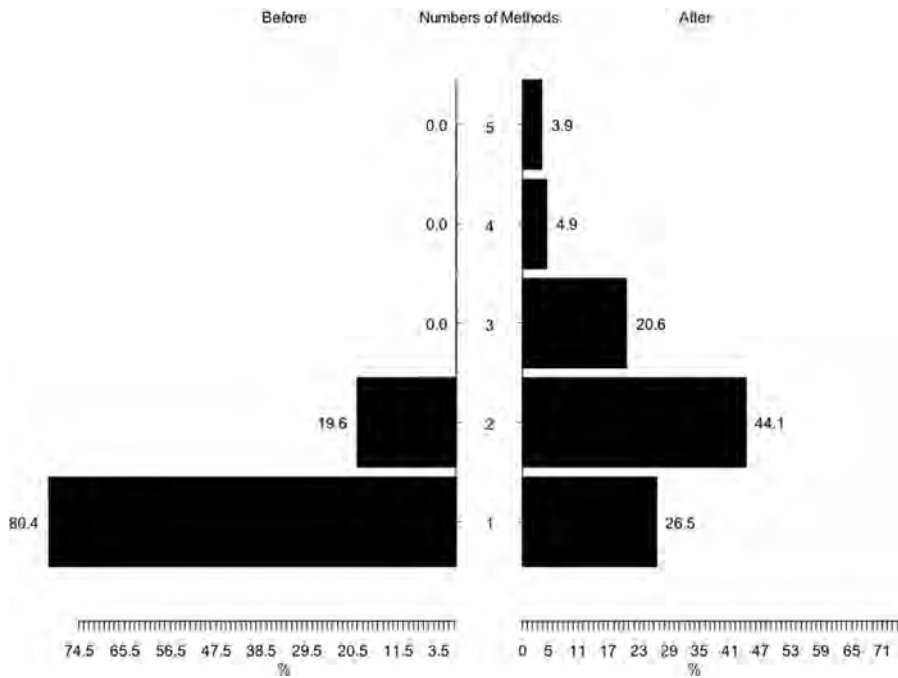


Figure 3. Changes in the number of the ‘possibly used’ documentary modes before and after the filmmaking courses.

participatory and reflexive modes, which 38.23% and 17.64% of participants, respectively, said they would consider using (Figures 1–2). No participants before the courses showed any interest in the performative mode; however, two female participants opted for this mode after the workshop (data not shown in the figures).

The filmmaking courses not only changed participants’ choices of documentary modes but also increased the overall number of modes that they said they would consider using (Pearson’s Chi-squared test, $X^2 = 67.368$, $df = 4$, $p\text{-value} = 8.155e-14$, and Spearman’s rank correlation coefficient 0.303, $p\text{-value} = 0.002$). Before the courses, 80.39% of participants said they would have only used one documentary mode and 19.61% two modes. Yet, after the courses, the number of participants interested in just one mode fell to 44.12% and the number of participants interested in two modes increased to 26.47%. In addition, 20.59%, 4.9% and 3.92% of participants said they would consider using three, four or five different documentary modes, respectively (Figure 3).

In all, 72% of the scientists who attended the filmmaking courses were female. There were no statistical differences between female and male scientists regarding choices of documentary modes either before (Fisher’s Exact test, $p\text{-value} = 0.144$) or after (Fisher’s Exact test, $p\text{-value} = 0.678$) the filmmaking courses.

Conclusion & discussion

The documentary modes proposed by Nichols (2001) are considered as ‘rational discourse’. However, in her book *Looking Two Ways*, Toni De Bromhead (1996) criticises this ‘rational discourse’ of Nichols arguing that a documentary reaches people through their ‘hearts and souls not just minds’ and that what is really essential to documentary storytelling is ‘emotional response and empathy’. Nevertheless, this ‘rational discourse’ is very appropriate for the scientists on the filmmaking courses as, due to their ‘rational scientific background’, it is easily understood.

With no filmmaking background the expository mode is the most logical one for a scientist to use. It possesses the same traits and conventions as scientific narratives and bolsters the notion of objectivity and authenticity (e.g. scientific papers and presentations; Boon, 2014; Sollaci & Pereira, 2004; Sternberg, 2010) since, even if most scientific research is mainly based on observation, scientific communication is based on exposition. The observational mode was the second option, a choice that, likewise, can be explained by the observational methodology of scientific research. However, our questionnaire did not include details about participants' scientific background, the purpose of the films and the targeted audience. Only few scientists opted for the participatory and poetic modes, which could be attributed to their lack of knowledge of these modes and of the possibilities these modes offer.

The filmmaking courses changed scientists' preferred documentary modes. The expository and observational modes would still be used by the 'scientists-as-filmmakers' but less often. Surprisingly, the potentially most-used mode was the poetic mode. This could be due to a real need for communicating science emotionally to the wide audience, or simply because this mode was novel. Scientists were also interested in the participatory mode since, if a question is posed or a controversial topic is raised, and the filmmaker is involved in objectively showing the audience the filmmaking process of their subject, then the creative process can be regarded as 'investigative filmmaking'. This resembles the scientific mentality of first posing a question and then objectively seeking the answer.

The scientists did not find the performative mode very attractive and after the filmmaking course it was the first choice of only two female participants. This could be attributed to the traits and conventions of this mode, which is thought of as being the opposite of the observational mode, and hence scientists may regard it as 'manipulative'. The performative mode links the filmmaker to the story and constructs subjective truths. This type of 'subjective truth' could work for some scientists as a contrast to the scientific concept of truth, or simply be the mode that best suits the audience they have in mind. But this need not always be the case. Although performative documentaries at first glance seem to have little in common with traditional documentary modes of science communication, a study by Little (2007) claims that 'the performative mode of documentary filmmaking is an emerging, intrinsically powerful and virtually unexplored weapon in the arsenal of science documentary'.

Although it was expected that filmmaking courses would change scientists' preferred documentary modes, the direction (from expository mode to one or more of the other modes) and the dimension of this change were not clear. These changes could be attributed to the need for appropriate modes for effective science communication or for reasons connected to quality and style (Little, 2007; Mellor, 2018).

The significant increase in the range of preferences of documentary modes after the filmmaking courses may reveal a real need corresponding to the film projects that participants have in mind; that said, it may simply be a reflection of scientists' desires, stimulated by the courses, to try out as many modes as possible.

More women than men attended the filmmaking courses; there were no statistical differences between genders in the choices of the documentary modes. Gender bias in our study has no consequences in the validity of the results, due to the relatively high sampling size (101 participants) and the fact that gender bias is normalised in the used statistical methods. However, the extent of gender bias in science and art is an on-going debate and some authors argue that art education is woman-stereotyped (Dalton, 2001). This clear gender bias means more young (participants in the filmmaking courses were mainly PhD and post-doctoral students) female *scientists-as-filmmakers*, but how this bias might affect the future of science communication to the public is not yet clear, since there is another gender bias playing out against women in academic hiring, tenure and promotion, as well as in science communication (Knobloch-Westerwick, Glynn, & Huges, 2013; Powell, 2018).

We believe that there was no data bias between groups because the same teachers using the same didactical material took all the filmmaking courses. We also believe in the replicability of our results, however these results could be slightly affected by the scientific background of the participant

scientists and/or their targeted audiences, as well as by the didactical materials and teaching styles of the teaching staff. None of these three factors were considered in the study.

This study highlights the importance of the filmmaking courses that universities and scientific institutes worldwide offer their students and scientists as part of outreach programmes designed to encourage them to produce their own science films. The time limitation of these workshops (usually between 1 and 3 days) restricts their focus in many times to the technical parts (camera, sound, lighting, editing ... etc.), neglecting fundamental parts of filmmaking, like narratives and documentary modes (Angelone et al., 2019). Therefore filmmaking courses for scientists might be designed to facilitate a broadened perception of documentary filmmaking among scientists, so that the forthcoming generation of 'scientists-as-filmmakers' can make use of a greater variety of types of documentaries, which is pivotal for effective science communication, with quality and style.

Filmmaking courses for scientists and the science films produced by the coming generation of 'scientists-as-filmmakers' require wider and more multidisciplinary scholarly study in two fields, namely, science education and science communication. The content and outcomes of educational filmmaking courses for scientists still need to be thoroughly evaluated and in-depth analyses of this type and the impact of science films on audiences should be incorporated into film and media studies.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Chapter 4

The creation of science film festivals: lessons from behind the scenes at the Global Science Film Festival

Paper submitted to Educational Media International



Photography from 'Video-Journalism for Scientists at Vision du Réel Film Festival', Nyon 2019

The creation of science film festivals: lessons from behind the scenes at the Global Science Film Festival

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Abstract

Films are powerful tools of scientific communication. They help scientists share their research with peers and a wider audience. Due to the proliferation of science films in recent decades, science film festivals have burgeoned worldwide. However, there are still serious obstacles facing the creation of new science film festivals, of which the most challenging is the lack of experience of organising such events, a skill not taught to most academic scientists.

Unfortunately, the experiences of creating new science film festivals are never shared in academic publications. This paper describes the behind-the-scenes lessons acquired from the setting up of a new science film festival, namely the Global Science Film Festival in Zurich, Switzerland. The lessons learned regarding a whole series of issues (festival name, logo & award, timing, duration and location, film programming, target audience, ticketing, organisers, partners, sponsors and collaborators, volunteers, juries, side events, and budget) will help scientists and scientific institutes worldwide set up and run their own science film festivals. Further studies addressing the successes and challenges faced in the design, development, implementation and evaluation of science film festivals are needed.

Keywords

Science communication, Film festival, Education, Academies, Project management, Filmmaking, Storytelling, Filmmaking marathon, Science events, Science Film Festivals Network

One of the major challenges facing scientists is how to communicate complex concepts and detailed content in ways that are concise and appealing to both peers and a wider audience. Through films, scientists can engage viewers visually, aurally, viscerally and emotionally, and in this way reach out to a vast audience (Berlin, 2016; Pasquali, 2006 & 2007). Films are also a powerful educational tool for scientists (Marchant 1974). Recently, there has been a proliferation in the demand for science films (Gouyon, 2015; Agrawal, 2001; Career Feature, 2018; National Academy of Sciences, 2008) and, as a result of this boom, science film festivals have burgeoned in recent decades (e.g., Bristol Science Film Festival <https://brisscifilm.wordpress.com>; Science Film Festival from Goethe Institute www.goethe.de/ins/th/prj/wif/fes/enindex.htm; Imagine Science Films <http://imaginesciencefilms.org>; Festival International du Film Scientifique Pariscience <https://pariscience.fr>; and Academia Film Olomouc <https://afo.cz>).

Science film festivals are thematically restricted events. They are more than just simple platforms for science film circulation as they aim to “promote science literacy and awareness of contemporary scientific and technological issues through film” (e.g. Science Film Festival from Goethe Institute) and “promote a high-level dialogue between scientists and filmmakers” (e.g. Imagine Science Films Festival).

The increase in the number of science film festivals (Hoffman, 2008; Bultitude, McDonald, Custead, 2011) is part of a generalised global increase in the number of film festivals; indeed, in 2010 industry experts estimated that around 3,500 film festivals are held annually worldwide (Rüling & Pedersen 2010). Nowadays, we have no clear idea of the true

current number of film festivals, although it is evident that numbers are growing significantly or even exponentially.

In the light of the growing scale and importance of film festivals, academic studies are now part of film and media studies (Archibald & Miller 2011; De Valck & Skadi 2009; Papadimitriou & Ruoff 2016; <http://www.filmfestivalresearch.org>). Even so, science film festivals have still not received any scholarly attention.

Communicating science to the lay public is widely recognized as a responsibility of scientists, and hence general consensus exists within the scientific community that scientists outreach educational programs are needed, to restore the broken bridge between science and society (Leshner, 2003). Outreach training should not focus simply on increasing public understanding of science, because the problem is not merely a lack of scientific comprehension. The problem is more about public engagement than public understanding of science (Leshner, 2007; Vesterinen, Tolppanen & Aksela, 2016). Hence outreach educational programs need to be broadening, and one of the outreach training top priorities should deal with science events planning and management, and specially science film festivals (Angelone 2019).

The aim of this paper is to report behind-the-scenes experiences organizing a new science film festival using the Global Science Film Festival (www.sciencefilm.ch) as an educational model. This film festival held over two days in September 2017, attracted about 1500 viewers for watching 14 short-length and full-feature films. These experiences listed here will help scientists and scientific institutes worldwide set up and run their own science film festivals.

The dream of a science film festival

Our idea of organising a science film festival dates from October 2014, when the first *Filmmaking for scientists* course was offered to PhD students from the University of Zurich

and the Swiss Federal Institute of Technology ETH in their Life Science Zurich Program. After finishing the filmmaking workshop, we realised that our PhD students were now capable of producing their own films, albeit not yet in a professional way as *scientists-as-filmmakers* (Angelone 2019), but that this new potential generation of *scientists-as-filmmakers* would need a platform for their films and somewhere to interact with professional filmmakers. Thus, the idea was born to base a festival around the science films produced by this new generation of *scientists-as-filmmakers*, bearing in mind the power of film to connect science with society. Consequently, the aim of the envisioned Global Science Film Festival was “to promote constructive dialogue between filmmakers, scientists and society about global and essential challenges that we are facing as human beings.” Almost three years passed between the initial idea and the first edition of the festival in September, 2017, in part because of a lack of experience in organising film festivals and the fact that the festival was carried out relying almost entirely on volunteers. Many of our volunteers were PhD and Postdoctoral students with very limited free time. Our aim is to continue the film festival as an annual event beginning in 2019.

I. Festival name, logo and awards

We felt that the science film festival’s name, logo and awards should ideally reflect its theme and location, which in our case was Switzerland. The theme for 2017 was environment and nature and so we settled on the name, “Global Eco Film Festival.” For future editions we hoped to widen the scope to involve all scientific disciplines and hence we have decided upon the broader name of “Global Science Film Festival.” The term ‘global’ emphasizes the broad spatial scope of the festival. Our selected logo consists of a wreath-like form shaped like the horns of two Alpine ibex, a symbol of nature and the environment in the high Alps. The ibex symbol proved useful in the creation of film awards, so that the best films (selected by a jury) received a ‘Walking Ibex’ trophy, inspired by the charismatic Swiss artist Alberto

Giacometti's iconic sculpture *Walking Man; L'Homme qui marche I*. Both festival name and festival award recapitulated some of Switzerland's iconic themes. We were unfortunately unable to join cash with these prizes, but believe it advisable to have cash prizes if the budget allows.



Fig. 1 Photograph of the organisation team at the first edition of the Global Science Film festival.

II. Timing, duration and location

We decided to stage our film festival in September since it is the first month of the first university term in Switzerland. Moreover, it is when universities and their students and staff have begun their new session, and have more free time to attend such an event. The weather is an important factor in Switzerland to coax people out of doors; nonetheless despite witnessing good weather during the film festival, the films played to almost full houses. Such considerations of weather and timing led us to plan the next edition of our film festival in November, 2019. Regarding duration, we decided to hold a two-day festival on a Saturday and Sunday due to budgetary limitations. Indeed, many film festivals – and not just science

film festivals – only last for two days (Rüling & Pedersen 2010). Our events began in the morning and lasted all day, allowing us to take advantage of our theatre's maximum capacities. We chose to hold the Global Science Film Festival in Switzerland's largest city, home to numerous universities and corporations. The screenings and ceremonies took place in the Filmpodium Cinema (www.filmpodium.ch) in the middle of the city (Photograph 1). The success of our festival's first edition festival leads us to plan our next edition in two cities, Bern and Zurich, and we hope to expand in the following year to a third Swiss city, Lausanne.

III. Film programming

Categories

We chose to screen films in two categories (both including national and international submissions): 1). Feature-length documentaries and fiction films (50 minutes or more), 2). Short films (documentary, fiction, animations and musical videos, up to 50 minutes)

We now realize the advantages of adding a third category, that of short Swiss films made by young scientists, research institutes and universities. Budding generations of *scientists-as-filmmakers* are not professional filmmakers and hence it allows them a venue to present their work.

Selection criteria

We decided that films can be of any scientific discipline, length and format as long as they fit into one of the listed categories. We felt it imperative that films are up to date, and that no more than two years has elapsed since their production dates. Important older films can be screened 'out of official competition' but should not form more than 20% of the whole program.

Film submission

There are many online platforms for registering science film festivals through which films can be received from filmmakers (usually through private links with password, such as Vimeo)

and so there is no need for filmmakers to send DVDs or Blu-ray discs. This saves money and eases organisational matters (e.g. correspondence with filmmakers, film pre-selection and jury screening). Film festivals can register on these platforms for free with no fee required for film entries (which is important for fledgling film festivals that want to attract as many good films as possible). Some of these online platforms include FilmFreeway (<https://filmfreeway.com>), which already has over 7000 festivals registered and 600,000 filmmakers, Withoutabox (www.withoutabox.com), Festhome (<https://festhome.com>), Clickforfestivals (<https://www.clickforfestivals.com>) and Movibeta (movibeta.com).

For the first edition of Global Science Film Festival we only used Festhome and Clickforfestivals and received as possible entries 252 short and feature-length films from all over the world. For the coming editions we will also use FilmFreeway since it is by far the largest online platform for film submission, and we expect to receive over 500 films.

Ideally, the submission period should remain open for 4–5 months, and close three or four months before the dates of the festival in time for film selection and notifications to be sent out and travel arrangement to be made.

Selection criteria

Receiving many films from all over the world is encouraging and reflects the interest that filmmakers have in science film festivals. On the other hand, all submitted films have to be viewed and evaluated as part of the selection process. Three programmers from our team divided up the entries, and each watched and evaluated one third of the films. They drew up short lists of films that were watched in a second round and then discussed by the three programmers and the director of the festival.

The criteria for selecting films at film festivals are often very personal and tend not to be discussed or revealed by film festivals. From our personal experience the selection criteria were based on narrative and story structures, the artistic quality (cinematography) of the film, the story itself, the novelty of the topic and its relevance, and the scientific authenticity of the

story being told. In our film festival we also considered an even more in-depth criterion centred on the ‘storyteller’; moreover, we endeavoured to have equal gender representation of filmmakers. Another general selection criterion was the need for diversity and, more generally, we sought to achieve a balanced line-up comprised of a diverse range of filmmakers and topics. For instance, if we received two films about the problems of plastics in the environment, we would select only one, even if both were excellent. In this way, there is more space for other topics such as climate change, animal conservation and so on.

The final selection of the film program is nonetheless a thorny question and is not only based on submitted films. As a small film festival, we cannot rely only on films we receive through the online platforms and, for example, we sought titles in other film festivals and searched the Internet in order to identify the best films for our festival. Although many known filmmakers (and production companies) hesitate when it comes to submitting their films to small, recently established film festivals we still attracted a large number of high quality films.

Film material and working with cinemas

Once the short-list of films has been selected, producers must send in their physical films since the online versions are not suitable for screening in big cinema theatres and are useful only for the selection process.

Best film resolutions are provided by Digital Cinema Package (DCP), which consist of a collection of digital files that store and convey digital cinema (DC) audio, image and data streams. However, DCP files are very large with an hour of video DCP occupying 113 GB. Some production companies send their DCP online (with a link for downloading) and for this one needs a very fast Internet connection. Others send it physically in an external memory drive (by courier), which was expensive since the receiver (i.e. the film festival) needs to cover costs. We also had to be sure that the cinemas where we screen films support DCP format as not all do.

Some of our films arrived on Blu-ray discs whose quality is generally good enough for screening in the cinema (but not as good as DCP). Even so, we still had to bear the expensive courier costs. Short films are mainly sent online, as they do not occupy much space.

Once the cinemas receive the films (it is best to have them all one month before the screening) they download them onto their systems and return the hardware, including external memories and discs. Most cinemas prefer to have all film materials in hand one month before the viewings. If possible, all external memories and discs can be returned to the filmmakers in person should they visit the festival, thereby saving courier costs.

The issue of convincing famous filmmakers to attend

Well-known filmmakers may not be interested in screening their films in small, recently established, thematically restricted and volunteer-based film festivals with no cash prizes. The situation is even more complicated when the festival requires filmmakers to attend and present their films for discussion in question and answer sessions. Most film festival organizers need to sell their festival as big, important and glamorous. Generally, an independent film festival website with a professional look is essential. It is generally a good idea to avoid imbedding your website within those of universities or research institutes since this lacks professionalism. Attempt to screen films in modern cinemas or theatres rather than in classrooms, while ensuring that promotional posters and programs are attractive and professionally produced. The film festival should cover travel and accommodation costs of the filmmakers but as compensation can request waiver of the screening fee. If the filmmaker cannot attend the festival, and you feel that the film is key to the festival's success, perhaps the producer (or the main character) can attend the *scientists-and-filmmakers* debates. The other option is to bring the filmmaker to the festival on short podcast, which can be a cheap and effective solution.

Film screening fee

Film production companies generally request screening-fees for each individual screening of their films. The actual fee can vary depending on the film and its production budget, the age of the film, the country in which the film is screening, and the capacity of the theatre. Hence, the screening fee could lie in the range of about 100–500 USD per film. However, from our experience it is easy to convince a production company to accept a 100% waiver of the screening fees if, for example, the film festival pays for the filmmaker to attend and covers all other related travel costs. Likewise, it is possible to point out that you are a young film festival, that the audience is mainly university students, and that most of the audience will not pay an entrance fee (the festival is accreditation-based). If you cannot convince production companies to accept a full waiver of the screening fee, then a partial waiver may be negotiated.

Screen Programming

Our aim was to convince the audience that all films on the program merited their attention. We realize that short films attract fewer people than feature-length films, and that *scientists-and-filmmakers* debates are more appealing when they follow the screening of the film. Moreover, the screening program should include concise but compelling information about the films with a synopsis and link to the trailer. Pictures and short biographies of the filmmakers, scientists and moderators are essential so that the audience can establish a personal understanding of them even before attending the festival. The opening and award ceremonies should also be mentioned in the program.

The best known film festivals (e.g. Cannes, Locarno, Berlin, Venice and Sundance) announce their programs usually less than one month before the festival begins. This is due to the selection process (which prioritises premieres and newly produced films) and the desire to maintain a surprise factor for their fans (who will attend the festivals regardless of the programs). However, this strategy is not recommendable for science film festivals since we

will probably not be screening world premieres nor do we have a fan base that will attend irrespective of the programmed films. Hence, it is best to publicise the program significantly in advance, say two months before the festival opens. Many visitors to science film festivals are attracted more by the quality of the screened films and the visiting filmmakers than by the atmosphere of the film festival per se (see target audience).

IV. Target audience

The first thing to define when planning a science film festival is the target audience. For thematically restricted film festivals (as science film festivals are) there are three kinds of public: the general public (cinemagoers who are interested in watching films in general), the alternative public (interested expressly in the subject) and the business public (e.g. the film industry, people interested in buying and selling films, communication marketing and networking) (Monani 2013; Stringer 2008). Most thematically restricted film festivals attract both the general and alternative public but are less attractive for the corporate/business public. Thematic festivals rely on evoking spaces for specialized interests (e.g. ‘science’ for science film festivals), which in turn are geared toward public engagement (Stringer 2008). Given our experience from the Global Science Film Festival we tend to accept these conclusions, although we have no exact data confirming any assumption about what type of audiences attended our film festival. We will attempt to rectify this in coming editions.

V. Ticketing

Offering free entrance to all films could be considered as a good way of attracting audiences or simply a statement of intent designed to make science films accessible to everybody, even those on low incomes. Yet, offering free tickets can have a negative effect as people may associate free entrance with low quality; as well, they may postpone their decisions to attend screenings or change their plans at the last moment. Hence, we decided to charge an entrance

fee to the screenings that had a similar price to a normal cinema ticket in Switzerland (18 USD). We also offered a daily pass to all the films on a single day. As well, we gave passes (free entrances to all films) to all those who supported the film festival in any way and to all participants in the workshops.

We sold/gave away an average of 200 tickets per film (the cinema had 263 seats), which adds up to around 1500 tickets in two days. In future years, our aim is to increase the total number of tickets to 5000 by screening in other cinemas in Bern and Lausanne.

VI. Organisers, partners, sponsors and collaborators

It may sound illogical, but it is difficult to run a science film festival under the auspices of an official organisation such as a university or research institute. Film festivals are still regarded as worthwhile but not integral to universities and research institutes, or even of their multi-media and communication departments. Although there are individuals (e.g. students and researchers) from such institutions who are interested in film festivals, the actual setting up and running of a science film festival with a university or research institute is not a simple task. That said, universities and research institutes can partner and sponsor science film festivals, especially the side events (workshops and debates) that are somehow ‘directly’ related to science and the training of scientists. We managed to get several Swiss universities and research institutes involved including the Swiss Academy of Sciences, Life Science Zurich, Conference Universitaire De Suisse Occidentale, Universities of Zurich, Geneva, Lausanne, Fribourg, Bern, Basel & Neuchatel, ETH Zurich, the Swiss Federal Institute for Forest, Snow & Landscape Research WSL, and the Swiss Federal Institute of Aquatic Science & Technology EAWAG) as partners and sponsors, but they were mainly interested in the side events (workshops and ‘scientists-and-filmmakers’ debates).

Given the complications with running film a festival in collaboration with universities and research institutes, we went ahead with a group of filmmakers and scientists who are all

passionate about science films without creating any legal framework. However, having legal representation as an association does make life easier. Many foundations in Switzerland (e.g. Stiftung Mercator, Migros-Kulturprozent and Ernst Goehner Stiftung) only fund legally constituted associations and not private projects run by individuals or groups. In addition, legal associations in Switzerland do not pay taxes; hence, in November 2019 we established an association, the ‘Science Film Academy’, which embraces filmmakers and scientists from a number of Swiss universities and research institutes. Thus, the Science Film Academy henceforth will be the legally constituted organiser of the Global Science Film Festival.

When beginning the organisation of the Global Science Film Festival we thought that it would be a good idea to collaborate with major international film festivals and benefit from their know-how, contacts and infrastructures; however, we soon saw that this would not be advisable. Major international film festivals always see themselves as too big to collaborate with a small, freshly set up science film festival, and believe that their programs are rich enough – and even cover science films – to not need any thematic science film festival. Of course, this assumption is erroneous as science films are not well represented in major international film festivals, and so many low-budget science films are unable to compete and be shown in major international film festivals. Even when the Global Science Film Festival is about science, we will have to establish a new category ‘scientists-as-filmmakers’ for non-professional films made by young scientists, universities and scientific institutes.

VII. Volunteers

Working with an extremely low budget requires a passionate volunteer spirit and a lot of hard work. In all, 18 volunteers, mainly PhD and postdoctoral students who had participated in the 2014–2017 workshops *Filmmaking marathon*, *Storytelling and storyboarding science* and *Filmmaking for scientists* volunteered to help with the Global Science Film Festival. They chose to participate in the organization of the film festival due to their passion for science

communication through film and were a fundamental element in the success of the festival. They worked with the cinema, ran the website and social media (Facebook and Instagram), prepared posters and flyers advertising the film festival, managed the ticket sales, presented the films to the audience, and organised and moderated the ‘scientists-and-filmmakers’ debates.



Fig. 2 Photograph of the science filmmaking marathon workshop at the first edition of the Global Science Film festival.

Volunteers were not paid for their work. However, for the forthcoming 2019 edition, we have established a contract with Life Science Zurich (a common program for PhD students from Zurich University and ETH-Zurich) that will enable us to organise and train volunteers. The Life Science Zurich program believes that the Global Science Film Festival is a key part of a scientists' professional career since it provides invaluable opportunities for learning, networking, science outreach and exploring new fields. Moreover, the Global Science Film Festival offers career researchers an opportunity to develop transferable skills that will be attractive to multiple industries. Volunteer PhD students will receive one credit (equivalent to

30 hours of classes) for their work organising the forthcoming Global Science Film Festival in 2019.

VIII. Jury

The jury, or group responsible for judging the films, was composed of filmmakers and scientists. The jury should ideally consist of an odd number of members (e.g. 3 or 5) so should consensus not be reached on a particular film, a vote can be taken. In some film festivals, jury members award each film points (0–10) with the film accruing the most points being the winner. In other film festivals, each jury member selects his/her favourite three films with the most-selected film being the winner. In the case of our Film Festival, we decided that jury members made their selection after an active discussion with each other. The debate for the feature length category was not easy and lasted over an hour but in the end the jury reached a conclusion. In the short film category the debate was very quick since all jury members opted for the same film.

Ideally, jury members watch the films in the cinema theatre with the audience. However, this means that the winning films are not known until after the screening of the last film. As the award ceremony is best held directly after screening the last film, jury members should watch the films before the festival begins. They can watch them in a meeting held a few weeks before the start of the film festival, which was how the short film competition at the Global Science Film Festival was organised. Even so, for the feature films category, jury members watched only the last film (the one just before the award ceremony) before the film festival, and watched all the other films in the cinema theatre together with the audience. During the screening of the last film (which jury members had already seen), the jury met and selected the winning film for the feature length category.

We believe that the jury organisation for the feature-length film category in the first edition Global Science Film Festival was somewhat risky, since some of the filmmakers may

decide to leave the film festival before the award ceremony. This creates a problem as all the filmmakers must remain in the cinema during the award ceremony in case they have to personally accept the award. The best option is to have the jury meeting a few weeks before the film festival so that the winning films can be decided upon before the festival; obviously, though, the results are kept secret.

IX. Side events

It is sad but true that science film festivals are often regarded as simply film screenings by scientists and scientific institutes. Worse still, many scientists have never ever attended a film festival and find it hard to justify participating (organising or sponsoring) in a science film festival if it is 'limited' to film screening, competitions and award. To make a science film festival attractive to academic institutions, we prepared two side events, namely workshops and debates.

Workshops

The aim of the workshops was to attract young scientists, bachelor, master, PhD and postdoctoral students, to the film festival. We offered two kinds of workshops:

Storytelling and storyboarding science

In this workshop, scientists learned storytelling, narrative and documentary modes, film genres, script, storyboarding and the theory of film editing. The aims of this workshop were:

(i) To learn how to borrow communication strategies and techniques from film. This helps scientists prepare persuasive presentations and publications that will enthrall audiences and increase uptake by incorporating the attributes of film narrative (Olson, 2015; Dahlstrom, 2014; Anderson Crow & Jones, 2017; Martinez-Conde & Macknik, 2017); (ii) To enhance collaboration between scientists and professional filmmakers.

Science filmmaking marathon

During this competitive four-day workshop, 40 scientists and filmmakers worked in small groups and produced six films. Scientists mainly provide the ideas and, possibly, also the story, while the filmmakers take charge of the actual making of the films (Photograph 2). The best films from the science filmmaking marathon were screened at the Global Science Film Festival.

It is important that the workshops are held at some point directly before the film festival so that participants feel connected to the festival.

Debates ‘scientists-and-filmmakers’

These debates are intended to provide a chance for scientists, filmmakers and the public to interact. After each feature length film, we held a 20-minute debate between the filmmaker and an expert in the subject of the film. Filmmakers, scientists and moderators should sit on stage and the debates should be announced directly before the screening of the films. This will ensure that the audience does not leave after the screening finishes or as the credits roll.



Fig. 3 Photograph of the debate ‘scientists-and-filmmakers’ at the first edition of the Global Science Film festival.

Scientists and moderators like to watch the films before the official screening in the cinema to calm their nerves and prepare their answers to possible questions. It is also a good idea to have a meeting (scientists, filmmakers and moderators) before the screening of the films so that all can prepare the debate and avoid misunderstandings or embarrassing questions.

The debates should be short, around 20 minutes, and the moderator should be kept informed of the time remaining (5min, 2min, 1min and finished). Debates can continue informally afterwards (Photograph 3).

The ‘scientists-and-filmmakers’ debates can be filmed and uploaded onto the Internet to make them accessible to a wider audience.

X. Budget

The budget should be divided into four concepts: i) film program (this includes film submissions, selection process and screening, debate, jury and awards); ii) side events (mainly teaching costs and didactical materials); iii) advertising (website, posters, flyers, etc.), and iv) organisation (the organisation costs from the moment of film submission to the preparation of the final reports after the festival finishes).

The budget for the first edition was 34,000 USD. This was to cover the minimum of everything with all organisation work being volunteer-based. The first edition of the festival is largely an investment into future festivals. For the next edition of the Global Science Film Festival, our expected budget is about 64,000 USD, which does not include the costs of the festival administration (about five months work per edition). If we are unable to raise this amount of money, we will have to give up some ideas and change certain priorities. For more details see Table 1. In this table, some concepts have values of 0.0 USD (for the 2019 edition). They were left in the budget to ensure that readers are aware of their existence since, if one day they have to organise a festival, they will need to bear these concepts in mind.

Table 1 The proposed budget of the forthcoming Global Science Film Festival 2019. It does not include the costs of festival administration. We have included all possible concepts, even if we do not actually use them in 2019. However, they are important for scientists/academic institutes who want to organise science film festivals in other parts of the world as their cost may vary in future editions.

CONCEPT	DETAILS		COST	TOTAL COST	
FILM PROGRAM	Software, and online management	Film databank for submission/programming and administration	CHF -		
		Access to film databank (Cinando, Mediabiz, ImdbPro etc)	CHF -		
	Receiving and sending films	via courier companies (DHL, FedEx)	CHF 400.00		
	Festival catalogue	Data of film directors, producers of the submission process	CHF -	CHF 400.00	
	Guests (Film Directors)	Travel for 8 film directors (National and International)		CHF 6'000.00	
		Hotel for 8 film directors (National and International)		CHF 2'000.00	
		Allowance for 8 film directors (National and International)		CHF 1'000.00	CHF 9'000.00
	Guests (Scientists)	Travel for 8 scientists (all national)		CHF 800.00	
		Hotel for 8 scientists (all national)		CHF -	
		Allowance for 6 scientists (all national)		CHF 800.00	CHF 1'600.00
	Jury	Short films	Travel for 3 jury members	CHF -	
			Hotel for 3 jury members	CHF -	
			Allowance for 3 jury members	CHF 600.00	CHF 600.00
		Full-length documentary and feature films	Travel for 1 jury members	CHF 500.00	
			Hotel for 1 jury members	CHF 300.00	
		Allowance for 5 jury members	CHF 1'000.00	CHF 1'800.00	
	Moderators	Moderator day 1 honorary		CHF -	
		Moderator day 2 honorary		CHF -	CHF -
	Filming Debates	Filmmaker honorary for 2 days filming and 2 days editing (plus 1 day set up and testing)		CHF 3'000.00	CHF 3'000.00
	Networking and film selection	Visiting film festivals	Accreditation/Travel 2 person/ 2 festivals	CHF 500.00	
Hotels			CHF 500.00		
Allowance		CHF 200.00			
	Meeting with film directors, scientists and jury members		CHF 500.00	CHF 1'700.00	
Cinemas	Cinema Theatre in Zurich (2 days)		CHF 5'000.00		
	Cinema Theatre in Brern (2 days)		CHF 5'000.00	CHF 10'000.00	
Ceremonies	Opening und Award Ceremonies	Apperitive (300 persons)	CHF 3'000.00		
		Apperitive (300 persons)	CHF 3'000.00	CHF 6'000.00	
Prize	Trophy (Walking Ibex)		CHF 3'000.00	CHF 3'000.00	
	Cash	Feature length films	CHF -		
		Short films	CHF -		
	Scientists-as-filmmakers	CHF -	CHF -		
Fee of film-screening	8 Feature-length films (CHF 150.- each)		CHF 1'200.00	CHF 1'200.00	
WORKSHOPS	Filmmaking Marathon for Scientists & Artists	Trainers	Honorary 7 teachers (8 hours per day, 5 days)	CHF 10'000.00	
		Filming equipment incl. Insurance	Cameras, Lighting material, Sound gears	CHF 1'000.00	
		Educational material		CHF 200.00	CHF 11'200.00
	Storytelling and Storyboarding Science	Trainers	Honorary 1 teacher (8 hours per day, 1 days)	CHF 1'800.00	
		Filming equipment incl. Insurance	Cameras, Lighting material, Sound gears	CHF -	
	Educational material		CHF -	CHF 1'800.00	
Science Events Planning and Management	Trainers	Honorary 1 teacher (8 hours per day, 2 days)	CHF 1'800.00		
	Educational material		CHF -	CHF 1'800.00	
ADVERTISING	Website	www.sciencefilm.ch; www.gsff.ch	CHF 2'000.00		
	Flyers/Program		CHF 2'000.00		
	Internet/TV		CHF -		
	Video advertisement/documentation	Production	CHF 2'000.00		
		Pre- and Post-Production	CHF 2'000.00		
	Photo documentation	Photographer for 2 days festival	CHF 1'500.00		
	Posters	CHF 1'000.00	CHF 10'500.00		
Total ORGANIZATION	Festival/Workshops administration	one person, 5 months work per year	CHF -		
	15 Volunteers	Minimum costs for transport and food	CHF -	CHF -	
Total				CHF 63'600.00	

Executive summary for a successful science film festival

1. Good film program

- Good diversity with a balanced line-up consisting of a variety of filmmakers and contents.

- New and professional films with, if possible, a number of well-known filmmakers.
- Films related to research at academic centres and topical debates in society.
- Some film premieres (i.e. films that have never been screened publicly in any festival, cinema, or broadcast on television or online) in the country hosting the festival or, if not, at least in the city in which the science film festival is being held.

2. Professional cinema theatre

Avoiding screenings in classrooms. Classrooms make the film festival seem unprofessional and over-scientific, which can put off professional filmmakers.

3. Presence of filmmakers and debates

The presence of the filmmakers is fundamental for science film festivals. Audiences appreciate the presence of the filmmakers, as they like to discuss themes, storytelling and cinematography.

4. Workshops

Workshops were fundamental for attracting bachelor, master, PhD and postdoctoral students. At least one of the films produced by the workshop should be screened at the film festival.

5. Entrance charges but free accreditations

Offering free entrance to all films could be considered as a good way of attracting audiences or simply a statement of intent designed to make science films accessible to everybody, even those on low incomes. Yet, offering free tickets can have a negative effect as people may associate free entrance with low quality; as well, they may postpone their decisions to attend screenings or change their plans at the last moment.

6. Opening and award ceremonies

The opening and award ceremonies are important and essential parts of the film festival, and are where organisers, filmmakers, scientists, moderators and jury meet the audience. These ceremonies are an essential part of what separates science film festivals from a simple science film screening that has no jury, competition or awards. It is always more attractive for the

audience if awards are presented to winners personally. If filmmakers are not present in the award ceremony so at least they can send short videos with a winner's speech, even a Skype conference is a good option if the Internet connection is fast and the time difference between the two locations is reasonable.

7. Motivated team

Our team consisted basically of volunteer PhD and postdoctoral students, with no previous experience in organising film festivals. Moreover, many of them had never been to a film festival. However, all were motivated and are passionate about films in general and science films in particular. We used our time and sometimes our own money to ensure that the film festival was a success. One minor compensation was that we could watch films as part of our work, even though this small reward was not possible for the last screening because the cinema was full and we had forgotten to book seats for ourselves!

Conclusions

This is the first report of the behind-the-scenes experiences of how to set up and run a science film festival. The educational lessons from the first edition of the Global Science Film Festival regarding i) festival name, logo and award; ii) timing, duration and location; iii) programming; iv) target audience; v) ticketing; vi) organisers, partners, sponsors and collaborators; vii) volunteers; viii) jury; ix) side events; and x) budget will help scientists and scientific institutes worldwide create their own science film festivals. Coordination between science film festivals is fundamental. Such coordination already exists between the major international film festivals (e.g. Cannes, Locarno, Berlin, Venice and Sundance Film Festivals) through the International Federation of Film Producers Associations (www.fiapf.org/). Even thematically limited festivals (including environmental film festivals) such the Green Film Network GFN (<http://greenfilmnet.org>) have their own platforms. A similar platform – Science Film Festivals Network – is needed to coordinate the events

organised by associated festivals, to promote and distribute science films worldwide, and to encourage initiatives and projects related to science films. Further studies addressing the successes and challenges faced in the design, development, implementation and evaluation of science film festivals are needed.

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Chapter 5

Searching for identities in the realm of environmental film festivals

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Searching for identities in the realm of environmental film festivals

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Abstract

Environmental film festivals are burgeoning worldwide. They challenge, inspire and motivate people to go out and try and make a difference to their worlds. Yet, despite the growth in the number of the environmental film festivals, no study has ever attempted to collectively describe their identity modes, based on common traits and conventions. In this paper, we analysed and classified the identity modes that 64 environmental film festivals employ. Analyses were based on data collected through questionnaires completed by the festival organisations, and by analysing their websites. Although each film festival had its own particular name, timing, public, film and organizational modes, general collective patterns and identities did emerge. The identity modes discussed here are vital for i. improving the strategies of the existing environmental film festivals ii. the coordination between the already existed environmental film festivals, and iii. for the creation of future environmental film festivals.

Keywords: environmental film festival; festival studies; identity modes; eco-cinema; festival organization; eco-film, green-film.

Introduction

Film festivals have proliferated worldwide since the 1980s (Iordanova 2009). They range from major international events with global industry and media exposure such as the Berlin, Venice, Cannes and Locarno Film Festivals to geographically or thematically smaller-scale festivals that focus on such themes as science, the environment, human rights or Jewish and Arab culture. In 2003, the International Federation of Film Producers Associations estimated the number of international film festivals at 700–800 (www.fiapf.org). In 2010, industry experts calculated that around 3,500 film festivals are held annually worldwide (Rüling & Pedersen 2010). However, eight years later we have no clear estimation of the true current number of film festivals — yet it seems that their numbers are growing significantly.

In the light of their growing popularity, scholarly studies of film festivals have become incorporated into film and media studies (Archibald & Miller 2011; De Valck & Skadi 2009; <http://www.filmfestivalresearch.org>). Film festival studies range from analyses of the aesthetics of films and the role of festivals in the construction of national cinemas, tourism and marketing, to the organization of festivals and the theoretical framework of the public sphere (Getz & Andersson, 2009, Elsaesser 2005; Evans 2007; Harbord 2002; Mazdon 2006, De Valck & Loist 2009).

Environmental film festivals are thematically restricted festivals that are more than just simple platforms for eco-cinema circulation since they also act as meeting places where filmmakers and audiences can interact face-to-face (Monani 2013). They challenge, inspire and motivate people to go out and make a difference to their worlds by undertaking some kind of environmental action (Malamud 2008). Environmental film festivals stress the democratic nature of popular participation. Audiences are encouraged to interact with festival organizers and filmmakers within a setting that inspires conversation and dialogue. Such festivals are not simply forums for general entertainment since, in addition, they inspire and bring

communities together in a common cause.

As a research topic, specialized film festivals identity modes have received little and scattered scholar attention (Dawson & Loist). The few reported studies focused on the history of such festivals, festivals' name, economy and market, programming choices, circulation and location (Dawson & Loist 2018).

Film festivals identity modes are challenging and vital at the same time. They are challenging because they require multi-disciplinary researches, since film festivals are at the crossroads of multiple institutional and knowledge logics; e.g. art, commerce, technology, culture, politics and ideology (Harbord, 2009; Harbord, 2016). However they are vital for i. helping the existing specialized film festivals to improve their strategies; ii. the coordination between the existing specialized film festivals; and iii. the creation of future specialized film festivals.

Regarding environmental film festivals' identity modes, Monani (2013) took the first step in her article *Environmental Film Festivals: Beginning explorations at the intersections of film festival studies and ecocritical studies*. In this initial attempt to theorize the notion of environmental film festivals, Monani (2013) used the phrase the "written festival", a term coined by Daniel Dayan to highlight the printed material produced by and about a festival (Dayan 2000). Monani (2013) also examined the websites of numerous environmental film festivals in an attempt to understand how they constructed their public identities. The public sphere theory, first suggested by Jurgen Habermas, is a way of examining how ordinary citizens "ready themselves to compel public authority to legitimate itself before public opinion" (Habermas & Burger 1989). The environmental film festivals' terrain, as analysed by Monani (2013), includes a heterogeneous field of public engagements. Monani (2013) framed this heterogeneity within a schema of end-member festivals: the public sphere festival, the alternative public sphere festival, and the trade-show festival. She concluded that all festivals appear to champion ideas pertaining to both the public and the alternative public

spheres; yet, when she probed a bit deeper, it became obvious that festivals varied considerably in their commitment to these notions (Monani 2013). Few environmental film festivals fell neatly into a single end-member category (public, alternative and business spheres). When they construct and negotiate identities in the public spheres or alternative public spheres, and/or as trade shows, the complex ways in which these festivals work to establish their presence in a heterogeneous environmental and media landscape quickly become obvious.

Monani (2013) analyses one identity mode (public identity) of the environmental film festivals, the public identity, based on ‘Written festivals’, which is a term coined by Daniel Dayan to highlight the printed material produced by and about festivals (Dayan 2000). Notwithstanding, from our own experience as environmental film festivals organisers (namely Cinemambiente Film Festival and Global Eco Film Festival) and as part of the Green Film Network (GFN), which involved 38 environmental film festivals, we estimate that five identity modes are common and fundamental to all environmental film festivals, which worth to be studied and analysed, namely:

I. Name identity (environmental claims, location and scale)

- How do the names of environmental film festivals establish their restricted fields of environmentalism? The following words are used: ‘environment’ (or ‘environmental’), ‘eco’ (or ‘ecology’), ‘wild’ (or ‘wildlife’), ‘green’, ‘planet’, ‘sustainability’ (or ‘sustainable’), ‘Earth’, ‘Amazon’, ‘ocean’, ‘scenic’ and the name of a filmmaker (in memory of a famous environmental filmmaker). Some names of the environmental film festivals are in the local languages, but they already have English versions that we used in our analyses. Some environmental film festivals do not evoke environmentalism in their names.
- How do the names of environmental film festivals establish their locations (e.g. name of a city, region, mountain or lake) or scale (with ‘country’, ‘international’ or ‘global’

as keywords)?

II. Timing identity (frequency of creation, periodicity, time of year and duration in days).

- ‘Frequency’ of creation refers to the number of newly created environmental film festivals per year.
- ‘Periodicity’ indicates if the film festival is annual or biannual.
- ‘Time of the year’ is the month the festival is held. Some festivals screen films over a period overlapping two months (e.g., the Cinemambiente Environmental Film Festival: end of May to beginning of June). For data analyses, the month with most days of screenings, could be chose. Other film festivals modify their dates according to national or religious reasons. Thus, the Iran International Film Festival is held in the spring according to the timing of Ramadan. Cinema Planeta, Mexico’s Environmental Film Festival, is clustered around Easter. For data analyses, once could use the dates of their 2018 edition.
- The ‘duration’ of the film festival reflects the number of days of film screening.

III. Public identity (target public, entry fee and public scale)

- What kinds of people attend environmental film festivals? General public, alternative public and business public.
- ‘Entry fee’ consists of two categories, a. film festivals at which entrance to films is not free and b. festivals that are free.
- ‘Public scale’ refers to the number of tickets sold (or given away) per edition.

IV. Film identity (submission scale and film selection criteria)

- ‘Submission scale’ refers to the number of submitted films per edition.
- Film selection criteria

V. Organisational (organizers and sponsors) identity (corporations, governments, NGOs and academies).

Organisers (management and administration of the festival) and sponsors (economically support the film festival but not involved in the management of the festival) of film festivals could be grouped into four categories: corporations, governments, NGOs and academic institutions.

The aim of this paper is to collectively describe and analyse the five identity modes of the environmental film festivals, based on common traits and conventions.

Methods

We collected data from sixty-four environmental film festivals

- Thirty-eight film festivals form part of the Green Film Network (GFN), which “brings together some of the major film festivals that happen annually around the globe with focus on environmental issues”. The network aims “to coordinate the events of the associated festivals, promote and distribute films worldwide and encourage initiatives and projects that might help people ponder about the environment” (<http://greenfilmnet.org>).
- The other 26 film festivals were taken from the paper published by Monani (2013), and the web sources www.ecology.com (<http://www.ecology.com/2011/09/11/environmental-film-festivals/>), and www.filmfreeway.com.

The study employed a mixed method, website analysis and questionnaire responses:

1. Survey questionnaires

We contacted 35 film festivals from the Green Film Network, and 30 of them agreed to answer our questionnaires. Questionnaires included likert scale and open-ended questions. We used their replies to analyse the public, film, and organization identity modes.

For the public identity and to identify which kind of people attend environmental film festivals. We asked environmental film festivals to describe their public by awarding a total of 10 points to three categories of public (general, alternative and business). We also asked the environmental film festivals to describe the public they aimed to attract; likewise, they answered by awarding a total of 10 points to the three categories of public they hoped to attract (general, alternative or business).

2. Website analyses

The websites of the other 34 film festivals were analysed. These analyses were included (together with the other 35 film festivals from the GFN) in the analyses of the name and timing identity modes.

Results and Discussion

The true number of self-proclaimed ‘environmental film festivals’ is hard to pin down. In our study we included only film festivals with a clear focus on the environment. However we are aware that there is a shifting in the meaning of ‘environment’ within the field of communication and the advent of posthumanism. Film festivals like Black Maria Film and Video Festival (www.blackmariafilmfestival.org), United Nations Association Film Festival (www.unaff.org), One World (International Human Rights Documentary Film Festival, <https://www.oneworld.cz>) and Interfilm Berlin (International Short Film Festival Berlin, <https://www.interfilm.de/en/>) were not considered in our study because the environment is not their core focus. The Artist Film Festival, for example, aims to “raise awareness for humanity, animals and the environment”, while The Black Maria Film and Video Festival addresses a range of topics “such as the environment, public health, climate change, substance abuse, gun violence, sustainability, immigration, people with disabilities, and LGBTQ issues”. The Internfilm Berlin and One World have an interest in eco-cinema but, although

part of the Green Film Network (GFN), the environment is not their main focus. We judged that including these film festivals in our study would distort our search for the identity modes specific to environmental film festivals.

We are also aware that our study does not include all existing environmental film festivals, especially the most recently inaugurated ones that are typically not well publicised. Some film festivals may only have websites in local languages (and no English version), others may even not have independent websites as they are only one of a profusion of other events. Nevertheless, we are confident that our study of 64 environmental film festivals is representative of the patterns of identities (identity modes) in the realm of environmental film festivals.

Based on traits and conventions, we established five identity modes in this type of film festival:

I. Name identity (environmental claims, location and scale)

- Environmental claims

The great majority of the environmental film festivals used only three terms ‘environment’, followed by ‘eco’ and ‘green’ for expressing environmentalism. The use of one of these three terms make it clear for the audience that it deals with environmental film festival. Only few environmental film festivals used alternative terms (‘wildlife’, ‘planet’, ‘earth’, ‘sustainability’ and ‘nature’), while terms like ‘Amazon’, ‘conservation’, ‘park’, ‘ocean’, ‘tree’ and ‘filmmaker’s name’ are only used by individual film festivals. These alternative terms could be a good option to claim unique identity to the environmental film festival, or sometimes to claim more thematically restricted environmental film festival, like ‘ocean’ (Fig. 1).

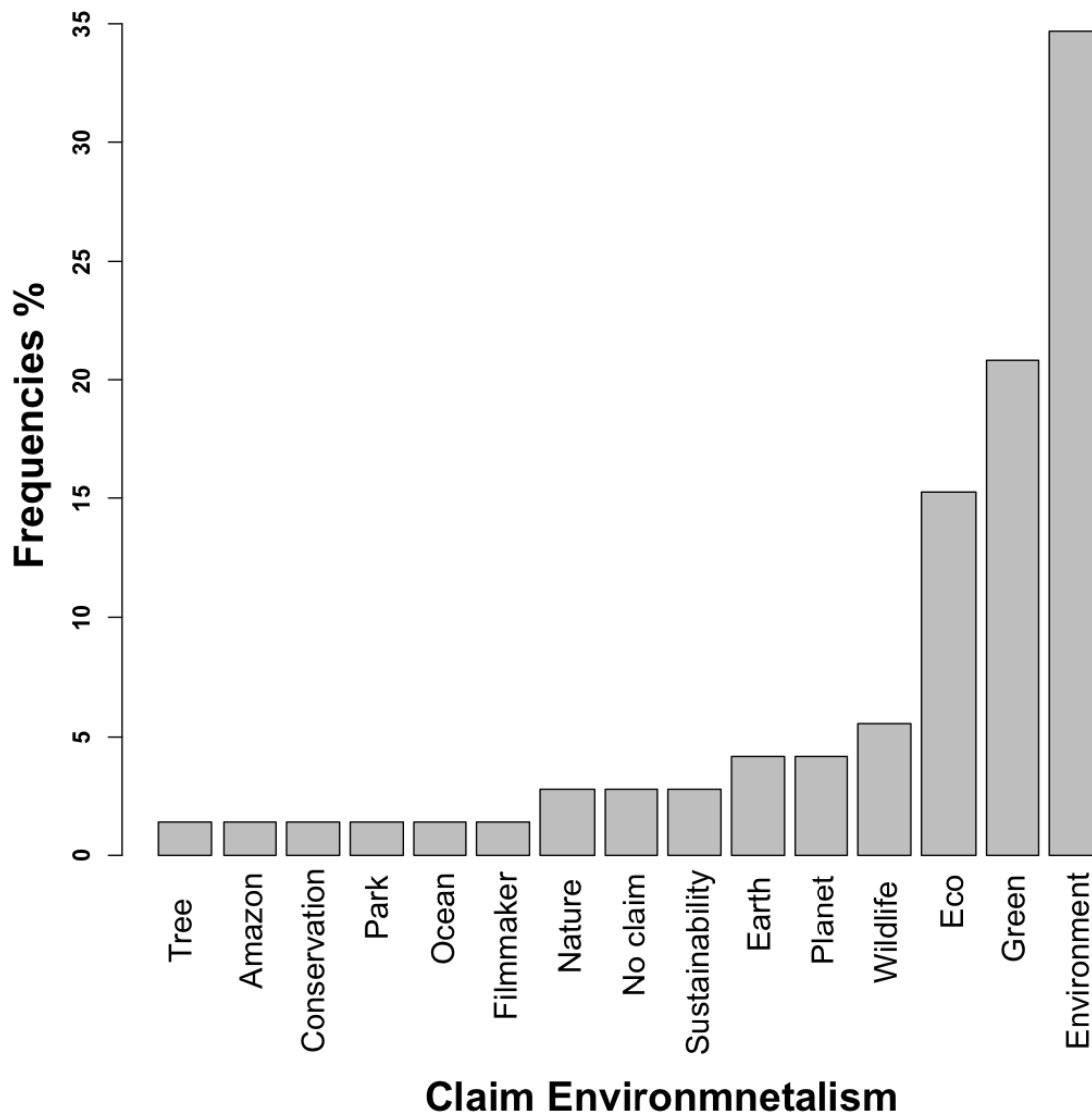


Fig. 1 Frequencies of the used terms asserting environmentalism in the names of environmental film festivals.

There have been changes over time (year of creation) in the use of these terms. For instant, the term ‘environment’ is losing ground in favour of ‘green’. Perhaps the change from ‘environment’ to ‘green’ had to do with the wider context provided by the term ‘green’ comparing with ‘environment’, and this has to do with the attempt of the environmental film festivals to attract wider audience. Nowadays, most of environmental film festivals show films on a much larger scale than “environment”: e.g. sustainable development, sustainable consumption and production of food, social responsibility of organisations, and migrations.

Juliana Paniagua (artistic director of Barichara Green Film Festival) stated, in her explanation of why her film festival used the term 'green' instead of 'environment', that "we wanted to expand the definition of what is commonly known as "environmental films" and show works that raise questions about all the possible aspects of mankind's relationship with its environment. Perhaps the change of language is somehow connected to the efforts environmental film festivals have made to broaden the language that is used in this context in order to change perspectives and reach more audiences"

- Claiming location and scale

'Location' (e.g. name of a region, city, mountain or lake) is the most used term, followed by the scale term 'international'. 'Country name' and 'global' are less used. The use of 'location' is common and helpful for locating geographically the film festival. A high percentage of environmental film festivals use 'international' and 'country', which indicates that many environmental films aspire to establishing a certain dominance at national and international levels, even if their impact is usually limited to a smaller (even local) scale. They tend to aim for an impact on a wider geographical scale, even when they are thematically confined to environmental subjects (Fig. 2).

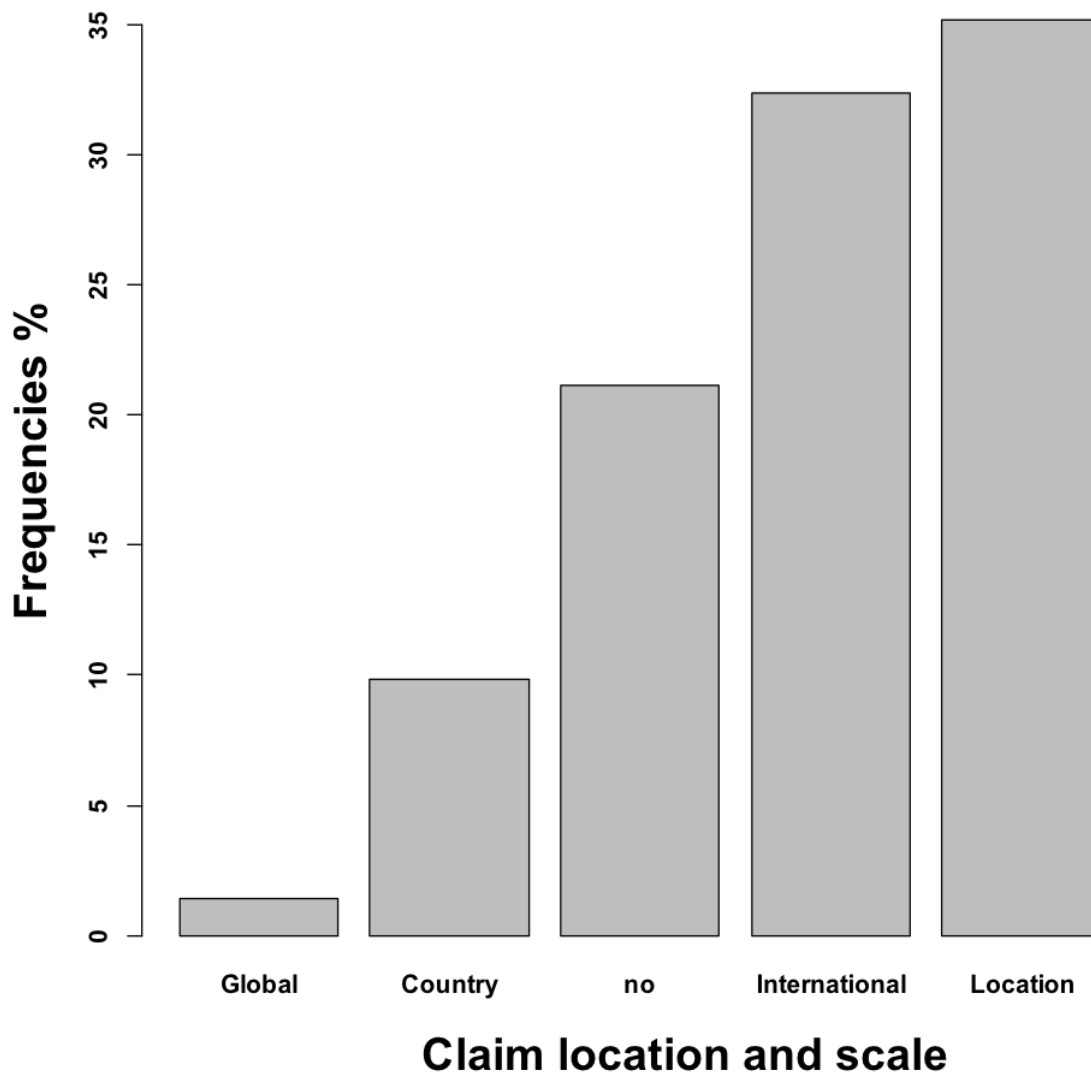


Fig. 2 Frequencies of the terms used to claim location and scale in the names of the studied environmental film festivals.

Changes are occurring in the use of these terms. In recent years, the term ‘country’ name is being more used than the term “international”.

Some environmental film festivals proclaim their ‘environmentalism’ without establishing any ‘location’. This could create confusion and so we suggest that such film festivals make their connection with ‘environmentalism’ as clear as possible.

II. Timing identity (frequency of creation, periodicity, time of year and duration in

days)

- Frequency of creation

It is clear that there has been a trend in recent decades to establish more environmental film festivals. Two main waves have occurred since 1991 and the booms in 1999 (six film festivals) and 2010 (eight film festivals) – at roughly 10-year intervals – could be related to specific environmental issues that have generated global debates and concern, such as the ozone hole and climate change. Specialized film festivals emergence was always relate to new social movements; e.g. feminist, indigenous, gay and lesbian...etc. (Vélez-Serna 2016; Dawson & Loist 2018). For example Cinemambiente Environmental Film Festival in Torino was established in 1996 as a reaction to Chernobyl disaster. The frequency of the creation of new environmental film festivals suggests that the number of environmental film festivals will increase in the future as more are created following this pattern of waves and booms. (Fig. 3)

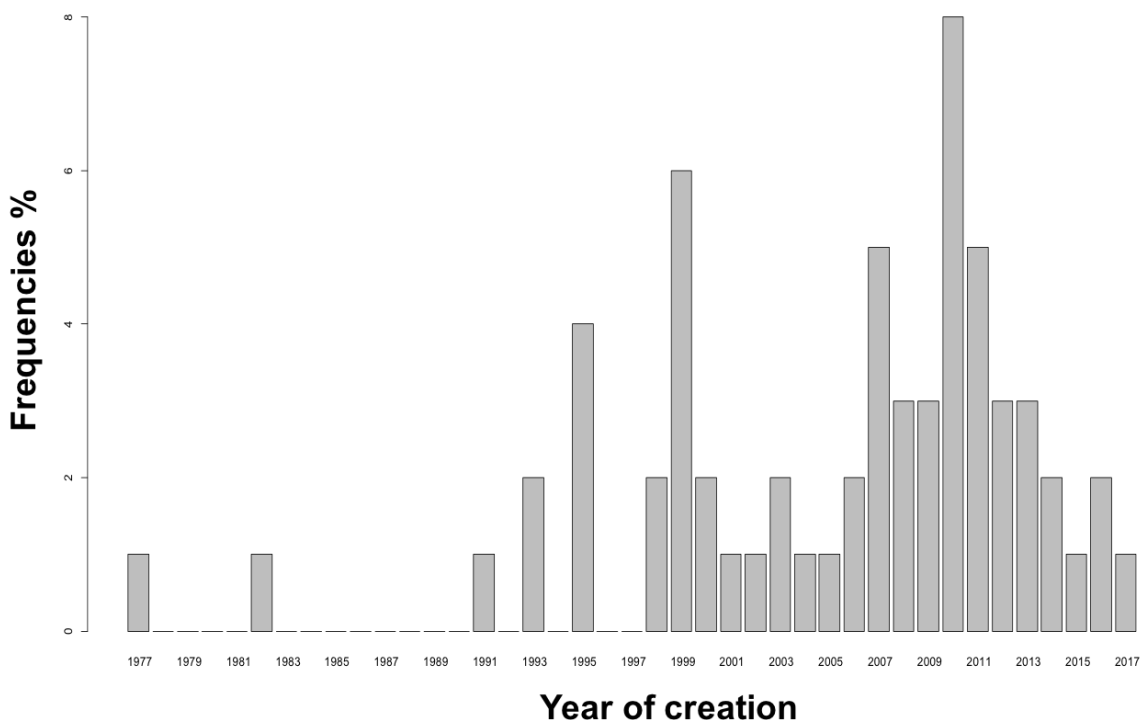


Fig. 3 Frequencies of newly created environmental film festivals per year.

- Periodicity

The majority of environmental film festivals are held annually (88.09%), only a few being celebrated biannually (11.9%). This also indirectly reflects the high demand/need for such festivals. The annual holding of environmental film festivals can be justified by the high output of eco-films, which satisfies the demand for high-quality environmentally related films. Unfortunately, no data exist regarding the number of eco-films produced in recent decades.

- Time of year

There are two high seasons for environmental film festivals: April-May-June and September-October-November. These are the spring and autumn seasons, associated necessarily with good weather since some film festivals hold open-air screenings. For attracting audiences, winter and summer are too risky as they coincide with holiday periods and the holding of certain major international film festivals (e.g. Locarno, Berlin, Venice and Sundance Film Festivals) (Fig. 4).

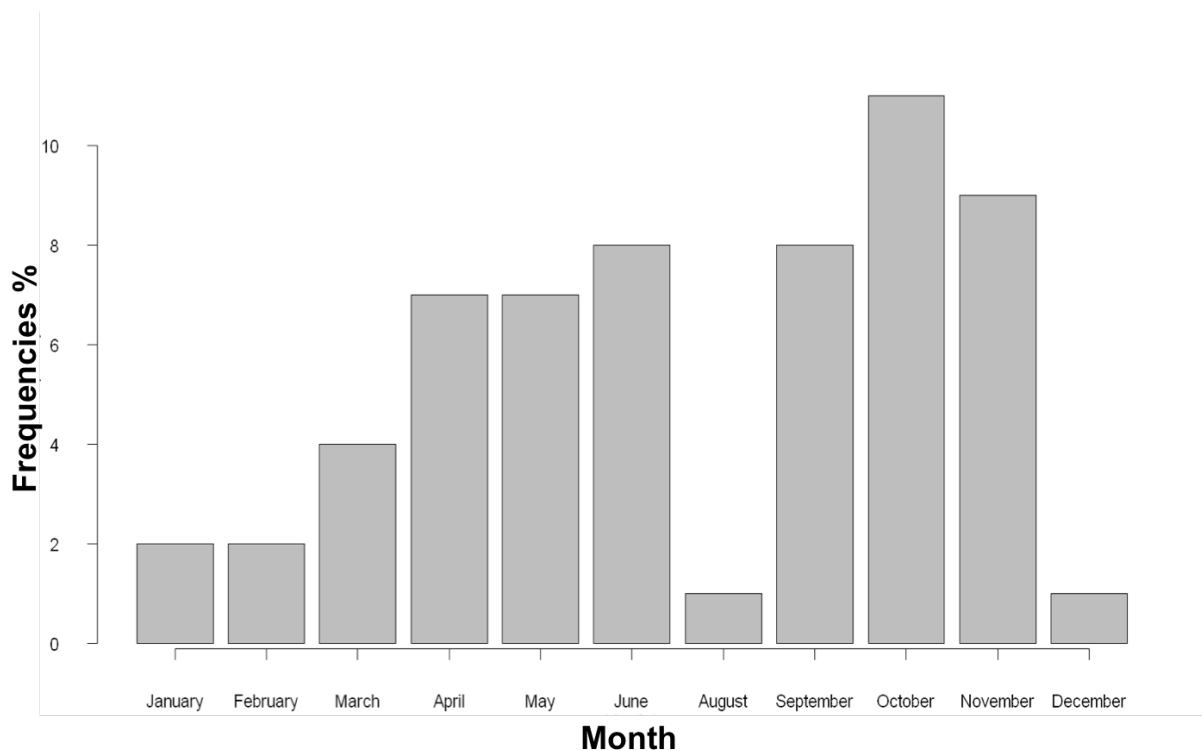


Fig. 4 Frequencies of holding of environmental film festivals per month.

On the other hand, holding many environmental film festivals during the same months could cause problems and create over-competition, especially given the tendency to invite filmmakers to attend screenings and discuss their films with the audience. The Green Film Network attempts to coordinate their associated film festivals, and further global coordination regarding the date of festivals needs to be improved. The major international film festivals are already coordinated in such a way by the International Federation of Film Producers Associations (www.fiapf.org/).

- Duration in days

Environmental film festivals have a very large range of screening days (between 2 and 180 days). However, although the mean and media (9.9 and 5.5, respectively) seem to be similar to other thematic non-environmental film festivals, we cannot support this affirmation with data. The environmental film festivals with the longest screening periods are usually those that are held in more than one city; for example, the CineAmazônia screens films in different cities in Brazil over a period of six months, and the Iranian is held in only one week but in many cities at the same time (e.g. 155 cities in 2017).

III. Public identity (target public, entry fee and scale)

- Target public

The heterogeneity of the target public is notable in environmental film festivals. Most of these film festivals attract both the general public (cinemagoers who are interested in watching films in general; 40.5±13.7%) and an alternative public (interested expressly in the environment; 46.6±12.3 %). The corporate/business public (e.g., film industry, people interested in buying and selling films, communication market and networking; 13.3±12.4 %) finds environmental film festivals less attractive. In deed, the films are entered in environmental film festivals to be shown and discussed, and hopefully to motivate people to go out and try and make a difference to their worlds. These festivals aim to attract a more general (44±12.3) and/or more business/corporate public (19.1±11.3) and a less alternative

public (36.9±8.6). This is a similar situation to other thematic film festivals, which often target both general and specialized audiences (Stringer 2008). Thematic festivals rely on evoking spaces for specialized interests, which in turn are geared toward public engagement (Stringer 2008). Our results agree with Monani's interpretations, even though her study was based on the 'written festival', that is, websites. 'Written festivals' is a term coined by Daniel Dayan to highlight the printed material produced by and about festivals (Dayan 2000). Monani concludes that most analysed environmental film festivals do not fall neatly into a single category. Instead, they exhibit characteristics of more than one type, which is exactly what our questionnaire-based study revealed.

- Entry fee

Most environmental film festivals do not require payment to attend films (66%). This could be considered as a strategy to attract audiences or simply as a statement of principle and mission to make these films accessible to everybody, even those with low incomes. Environmental film festivals have a very large range in the number of sold (or given away) tickets per edition (roughly 500–150,000). However, although the median and mean figures (2875 and 14255, respectively) resemble those of other thematic film festivals (e.g., human rights or science), we have no data to back this assertion. These numbers are to be considered high, if we compare them with the largest commercial film festival; e.g. Cannes Film Festival in France, with 350,000 spectators (Grunwell 2007). Outliers with high audience numbers are due to the long runs of some environmental film festivals and the fact that eco-cinema tours take place in many locations.

The number of sold/given away tickets could be regarded as a criterion for the success of a film festival. Nevertheless, this type of data is very difficult to analyse since it depends on many factors that we cannot control for, including country, city, time of year, duration of the festival, age of the film festival, number and size of cinemas, ticket mode (free or paying) and the films screened.

IV. Film identity (submission scale)

- Submission scale

Environmental film festivals vary greatly in terms of the categories of film screening/competitions. This categorization includes:

- Classical categorization: fiction, documentary, musical and animation, with some more specific productions including promotion films, kids' films and TV documentaries.
- Length categorization: i.e., feature-length or short. Some films are of medium length (1 hour) like those shown at the Cinemambiente Film Festival. Other film festivals such as the Bozcaada International Festival of Ecological Documentary (BIFED) do not distinguish between short and feature-length films.
- Scale or location categorization: national or international.
- Special topic categorization: a special category for 'Success Stories'.

The median number of submitted short (511.42 ± 546.01) or feature (433.33 ± 575.47) films is very high (the total short and feature is 908.15 ± 1), which is a good indicator of the production of eco-films and the success of environmental film festivals. However, there are very big differences between the films submitted to one environmental film festival and those submitted to another. Although the number of submitted films could be taken as an indicator of the success of the festival, this would be very difficult to analyse since it is affected by many other hard-to-analyse factors such as the age of the film festival, the success of the film festival, the season, country, city, fee for film submission, whether or not the film festival invites filmmakers to attend, the ticket mode (free or paying), the number of sold/given away tickets, and the duration of the film festival.

- Film selection criteria

The criteria for film selection is very difficult to study and analyse as it is often very personal and tends not to be a subject that film festivals want to discuss (Czach, 2004). From our

personal experience some selection criteria are based on the artistic quality (cinematography) of the film, the story itself, the novelty of the topic and its relevance to current environmental problems, as well as the scientific authenticity of the story being told. Another selection criteria could be the hope offered by that the eco-film projects, since these type of films often tend to present the 'sad reality'. This could also explain why some environmental film festivals have a special category for 'Success Stories'. But some film festivals may have more in-depth personal criteria that centre on the 'storyteller', e.g. the voices of Global South, women, activists and indigenous voices. The statistics of the films screened at BIFED show that about 50 % of films are made by female directors. The BIFED also tries to have the Global South as well represented as the Global North.

V. Organisation (organizers and sponsors) identity (corporations, governments, NGOs and academic institutions).

The vast majority of environmental film festivals (82.76%) are organised by just one identity (corporation, government, NGO or academic institution) and only a very few have two (10.34%) or three (6.90%) organiser identities. Most environmental film festivals are organized by NGOs (72.41%), followed by governments (27.59%). It is remarkable that academic institutions are not considerably involved in the organisation of the environmental film festivals (10.34%).

There is greater diversity in the sponsor identities of environmental film festivals, which are mainly supported by one (44.83%) and two (31.03%) sponsors, although festivals with three (17.24%) or even four (6.9%) identities do take place. This indicates that sponsoring environmental film festivals provides rewards for sponsors. Governments are supporting the majority of environmental film festivals (65.52%). Corporations (58.62%) and NGOs (48.28%) also play significant role in supporting environmental festivals, while academic institutions are not engaged in sponsoring these festivals (13.8%). There is no correlation between the number of organiser identities and number of sponsoring identities,

and hence the general idea of ‘more organisers means more sponsors’ turns out to be false.

In our analyses of sponsor identity, we did not establish a special section for private charitable foundations or for individuals, even if they could be grouped in with the NGOs. This is especially important for festivals in the US such as the Environmental Film Festival in the Nation's Capital, where most of the funding comes from NGOs.

Despite the first impressions of these festivals as spaces where the public and specialized community gather and rub shoulders, each of these environmental film festivals has its own particular complex structure of institutional affiliations and sponsorships.

There is a clear mutual organiser-sponsor relationship between identities (academic sponsors support academic organisers, government sponsors support government organisers, and so forth). Academic institutions and NGOs provide little support (less than 13%) for non-academic and non-NGOs environmental film festivals, respectively. In the future, academic institutions and NGOs might play a more active role in supporting environmental film festivals as a means of guaranteeing their independence and motivating audiences to think in new ways and take action.

Conclusions

Based on traits and conventions, we created and analysed five identity modes in the realm of environmental film festivals, namely ‘name’, ‘timing’, ‘public’, ‘film’ and ‘organization’. Even though each of the environmental film festivals has its own unique complex identity, general patterns of identities can be discerned. These patterns are not categories or route-maps that put limits on the freedom of environmental film festivals but are, rather, general common traits and conventions. The conclusions about identity modes presented in this paper could help existing environmental film festivals improve their strategies. The results of this study were already presented to the environmental film festival within the Green Film Network

(GFN). The members of the GFN agreed that the coordination between environmental film festivals should benefit from the identity modes described in this paper. Furthermore, identity modes are undoubtedly pivotal for the creation of future environmental film festivals, which should concentrate as much on organisation and sponsoring, as well as the name, time, duration and target audience of the festival, as on the choice of films.

Implications

- The identity modes presented in this paper could help existing environmental film festivals improve their strategies. For instant, Juliana Paniagua (artistic director of Barichara Green Film Festival, a member of the Green Film Network) stated after reading our paper “I think this paper is useful to us in terms of the patterns it found and the subsequent strategies we will be able to build from said patterns in order to grow together. This is something we should take into account in future conversations about our collaborative work as GFN members”.
- Environmental film festivals, worldwide, need coordination by a central body. The Green Film Network is a very good start, but still a considerable number of environmental film festivals is not associated to this red.
- Environmental film festivals wish to have more general and business public comparing with the alternative public, and thence they have to develop strategies to achieve this goal.
- The planning and organisation of the forth-coming environmental film festivals should benefit from the identity modes of the already established ones in the last four decades.
- It is noticeable that a large number of environmental film festivals (more than 50%) are supported by government or corporation organisations. There may be drawbacks to

this type of support. How this support influences the political agendas, what to show and what not to show, of the environmental film festivals?

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Supplementary Material

Table 1 Analysed film festivals with their date of establishment, URL, location, time of year and duration.

Film festival name	Country	City	Website	Year of foundation	Green Film Network
American Conservation Film Festival	USA	Shephardsville, WV	www.conservat ionfilm.org	2003	No
Barichara Green Film Festival	Colombia	Baricharia, Santander	www.festiver.org	2011	yes
Belgrade International Green Culture Festival	Serbia	Belgrade	www.greenfest.r s/index.php/en/	2010	yes
BIFED - Bozcaada International Festival of Ecological Documentary	Turkey	Bozcaada	www.bifed.org	2014	yes
Borneo Eco Film Festival	Malaysia	Kota Kinabalu, Sabah (Borneo)	www.beff.org.m y	2011	yes
CineAmazônia	Brazil	Porto Velho - Ro	www.cineamazo nia.com.br	2003	yes
CineEco – Serra da Estrela International Environmental Film Festival	Portugal	Seia	www.cineeco.pt	1995	yes
Cinema Planeta, Mexico's Environmental Film Festival	Mexico	Cuernavaca	www.cinemapla neta.org	2008	yes
CinemAmbiente Environmental Film Festival	Italy	Turin	www.cinemamb iente.it	1998	yes
CineMare Int'l Ocean Film Festival Kiel	Germany	Kiel	www.cinemare.o rg	2016	yes
CMS VATAVARAN – International Environment and Wildlife Film Festival	India	New Delhi	http://cmsvatava ran.org	2002	yes
Colorado Environmental Film Festival	USA	Colorado	www.ceff.net	2006	No
Deauville green awards	France	Deauville	www.deauvilleg reenawards.com	2010	yes

Dominican Republic Environment Film Festival	Dominican Republic	Santo Domingo	www.dreff.org	2011	yes
Earth Vision Santa Cruz Environmental Film & Video Festival	USA	Santa Cruz, CA	www.earthvisionfest.org	1999	No
ECOCUP Green Documentary Film Festival	Russia	Moscow	www.ecocup.ru	2010	yes
Ecozine Film Festival	Spain	Zaragoza	www.festivalecozine.es/	2008	yes
Ekotopfilm International Festival of Sustainable Development Films	Slovak Republic	Bratislava	https://www.ekotopfilm.sk	1998	No
Environmental Film Festival at Yale	USA	New HAVEN, CT	www.effy.yale.edu	2009	No
Environmental Film Festival Australia	Australia	Melbourne	www.ffa.org.au	2010	No
Environmental Film Festival in the Nation's Capital	USA	Washington	www.dceff.org	1993	yes
Environmental Film Festival of ACCRA	Ghana	Accra	www.effaccra.org	2005	No
Environmental Film Festival of Albania (EFFA)	Albania	Different cities	www.effalbania.org	2013	yes
Environment and Wildlife International Film Festival and Forum	India	New Delhi	www.cmsvatavaran.org	2002	yes
Festival International de Cine Medioambiental de Canarias	Spain	Tenerife	www.ficmec.es	1999	yes
FICA - International Environmental Film Festival	Brazil	Goiás	www.fica.art.br	1999	yes
FICMA-International Environmental Film Festival	Spain	Barcelona	www.ficma.com	1993	No
Filmambiente	Brazil	Rio de Janeiro	www.filmambiente.com	2011	yes
Films for the Earth	Switzerland	Winterthur	https://filmsfortheearth.org/en	2011	no

Finger Lakes Environmental Film Festival	USA	New York	www.ithaca.edu/fleff/	1997	No
FReDD (Film Research and Sustainable Development) Festival	France	Toulouse	www.festival-fredd.fr	2009	yes
G2 Green Earth Film Festival	USA	California	www.theg2gallery.com	2013	No
Glimmerglass Film Days	USA	Cooperstown, NY	www.otsego2000.org/about/contact/	2013	yes
Global Eco Film Festival	Switzerland	Zurich	www.sciencefilm.ch	2017	yes
Golden Tree International Documentary Film Festival	Germany	Frankfurt	http://www.goldentreefestival.com	2016	no
Green Film Festival	Switzerland / France	Different cities	www.festivaldufilmvert.ch	2006	yes
Green Image Film Festival	Japan	Tokyo	www.green-image.jp/	2013	yes
Green Montenegro International Film Fest	Montenegro	Durmitor National Park	www.greenmontenegro.me	2015	yes
Green Vision International Environmental Film Festival	Russia	St. Petersburg	www.greenvision.infoeco.ru	1996	No
Greenmotions Film Festival	Germany	Freiburg	www.greenmotions-filmfestival.de/en/	2014	No
Greenpeace Film Festival	Belgium	Bruxelles (online film festival)	www.greenpeacefilmfestival.org	2012	yes
Innsbruck Nature Film Festival	Austria	Innsbruck	www.inff.eu/en/	2001	yes
International Environmental Film Festival (FINCA)	Argentina	Buenos Aires	www.imd.org.ar/finca	2010	yes
International Festival of Environmental Films of Chefchaouen	Morocco	Chefchaouen	www.festival.assated.com	2010	No
International Film Festival Ekofilm	Czech Republic	Brno	www.ekofilm.cz	1974	No

International Green Culture Festival, Green Fest	Serbia	Belgrade	www.greenfest.rs	2010	yes
International Kuala Lumpur Eco Film Festival	Indonesia	Kuala Lumpur	www.kleff.my	2009	No
International Wildlife Film Festival	USA	Missoula, MT	www.wildlifefilms.org	1977	No
International Wildlife Film Festival, Green Screen	Germany	Eckernförde	www.greenscreen-festival.de	2007	yes
Iran International Green Film Festival	Iran	Tehran	www.iigff.org	1998	yes
Jackson Hole Wildlife Film Festival	USA	Jackson, WY	www.jhfestival.org	1991	No
One Earth Film Festival	USA	Chicago	www.oneearthfilmfest.org	2012	No
Pelicam International Film Festival	Romania	Tulcea	www.pelicam.ro	2012	yes
Philadelphia Environmental Film Festival	USA	Philadelphia	www.philaenvirofilmfest.org	2016	No
Planet in Focus International Environmental Film Festival	Canada	Toronto	www.planetinfoocus.org	1999	yes
Princeton Environmental Film Festival	USA	Princeton, NJ	www.princetonlibrary.org/peff/	2007	No
San Francisco Green Film Festival	USA	San Francisco	www.greenfilmfest.org	2011	yes
SEFF - Emerald eco film festival	Croatia	Hrvatska Kostajnica	www.filmfreeway.com/SEFFSmagrdniecofilmfestival	2007	yes
Seoul Eco Film Festival	Korea	Seoul	www.gffis.org	2004	yes
Sondrio Festival International Documentary Film Festival on Parks	Italy	Sondrio	www.sondriofestival.it	1987	No
Tales from Planet Earth Film Festival	USA	Madison, WI	www.nelson.wisc.edu/tales	2007	No

Wild and Scenic Environmental Film Festival	USA	Nevada City and Grass Valley, CA	www.wildandscenicfilmfestival.org	2000	No
Wildscreen Festival	UK	Bristol	www.wildscreen.org	1982	No
Włodzimierz Puchalski International Nature Festival	Poland	Lodz	www.festiwalpuchalskiego.pl	1980	No

Chapter 6

What should scientists know before making films?

Paper submitted to Science Communication



Photography from 'Storytelling & Storyboarding Science' at Locarno Film Festival 2019

What should scientists know before making films?

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Abstract

The need for science films is booming. Scientists mainly make films in a non-professional way, i.e. ‘*scientists-as-filmmakers*’, or in collaboration with professional filmmakers. From my own experiences – teaching filmmaking for scientists, making science films and judging films at science film festivals – I have learnt that scientists need to be familiar with certain relevant peculiarities of science films before making their own films or collaborating with filmmakers. The numerous examples of failed science films made by scientists and the many wasted hours of miscommunication between scientists and filmmakers have motivated me to write this article. It is not about the techniques of filmmaking but, rather, is about certain particularities of science communication through film that all scientists should be aware of before undertaking the making of a film. This paper is about how to ensure that science film stories, narrations and modes match with the desired contexts, audiences and goals of science films.

Keywords: Science Film; Science Communication; Storytelling; Context; Audience; Goal; Narration; Documentary Mode; Personal engagement; Failed Science Films

Films engage viewers visually, aurally, viscerally and emotionally, and hence scientists can use films to communicate complex concepts and detailed content to both scientists and a wider audience (Berlin, 2016). Science films can be used in different contexts and with a variety of goals to target a wide range of audiences (Pascuali, 2007). Recently, there has been a boom in demand for science films (Kwok, 2018). Science films are mainly made by ‘*scientists-as-filmmakers*’, that is, “scientists who integrate filmmaking into their academic preparation, albeit in a nonprofessional way” (Angelone 2019), and are often the result of collaborations between scientists and professional filmmakers. However, many scientists jump aboard the science-film boat without any preparation, which potentially has two unwanted consequences: failed films and/or many wasted hours of miscommunication between scientists and filmmakers.

By ‘failed science films’ I refer to both i) cinematographically failed films due to a poor knowledge of filmmaking techniques (storytelling, narrative, framing, lighting, editing, and so forth) and/or ii) science films that do not match the desired contexts, audiences and goals that scientists hope for. Hence, it is pivotal that scientists are familiar with some essential peculiarities of film as a media before they make their own films or collaborate with filmmakers.

From my own experience – teaching filmmaking for scientists, making science films, and judging films at science film festivals – I believe that scientists should be aware of at least 10 peculiarities of science films:

I. Context

Film context refers to ‘where to show their films’. Is the science film to be published in a science journal that accepts film as a format (as a full publication or video-abstract) or shown in classrooms, department seminars (including thesis presentations), science cafés, film festivals and/or commercial cinemas? Film context affects the scientific content of the film.

‘How much science is in the film?’, which can range from ‘pure science’ for science journals to less scientific content for films prepared for commercial cinemas. The context of the film also affects its length and quality (i.e. the available time and conditions placed by the journal or seminar). Film festivals usually prefer to screen short films (less than 20 min) or feature films over 50 min. Commercial cinemas are not interested in short films.

II. Audience

Categorizing the audiences of science films is a very onerous task. Scientists would love to say that their films are made for all kinds of audiences, but this is not usually the case. If we use the classification designed by Baron (2010) – albeit not specifically made with science films in mind – we can categorise an audience in terms of their interests in the content of the film: 1. Are ‘scientists’ interested in how the film relates to their works? 2. ‘Media people’ are more interested if the science film makes news. In other words, ‘will it sell?’ 3. ‘Policymakers’ are more interested if the science film supports or refutes their legislation. ‘Do my voters care?’ 4. ‘Managers’ focus more on how the science film will solve problems on the ground. ‘Who will support it?’ 5. NGOs regard science films in terms of whether or not they fit their agenda. 6. The ‘general public’ will be interested in science films if their content matter. ‘Why does this matter to me?’

Science film audiences can be divided into two main groups; ‘scientists’ and ‘non-scientists’ but we should also take into account non-scientific subgroups including ‘media people’, ‘policymakers’, ‘managers’, ‘NGOs’ and ‘general public’.

III. Goal

One way of classifying the goals of science films is to identify the expected responses of the viewers using the AEIOU vowel analogy. This analogy, proposed for science communication

in general and not only for science films, stands for Awareness (A), Enjoyment (E), Interest (I), Opinion-forming (O) and Understanding (U) (Burns, O'Connor, & Stockmayer, 2003).

Scientists may aim to provoke one or more of the AEIOU responses in viewers.

IV. Personal engagement

“Scientists agonize over issues related to advocacy: what is acceptable for scientists to do and what is not?” (Baron 2010). Scientists cringe at the prospect of presenting what they know to the public or policymakers for fear of being labelled as advocates. How, as a scientist, do you confront the reality that you also have values, interests and a personality? Scientists need to decide ‘how far to push their personal values, interests and personality in their films?’ Pielke (2007) argued that scientists have a choice in how they engage with politics and society and identifies the following four idealized roles:

- **The Pure Scientist**

Focuses on research without any consideration of its practical use. He or she contributes to the peer-reviewed literature and has no direct interaction with decision makers.

- **The Science Arbiter**

Wants to stay removed from policy, but will answer specific questions within the scope of his or her expertise. He or she will interact with decision makers and the media, but only regarding questions that can be resolved by science.

- **The Honest Broker of Policy Alternatives**

Participates in the decision-making process by clarifying and expanding the choices available to decision makers. He or she actively integrates scientific knowledge with stakeholder concerns and places information in the context of a wide range of policy options.

- **The Issue Advocate**

Directly participates in the decision-making process by attempting to narrow the range of possible decisions and advance a specific political agenda.

Pielke (2007) argues that members of the scientific community fulfil each of these four roles but that the choice will vary under different scenarios of uncertainty, consensus and political relevance. The key is to clearly distinguish when you are talking about your science and when you are speaking as a citizen. “We must always admit where our expertise ends and where our personal value judgments begin, such as recommending specific policies. Policy choice is always a value judgment” (Schneider 2003).

V. Story

It is disappointing that very few scientists know what a story is. From my experience, I would say that less than 5% of the scientists that I taught ‘filmmaking for scientists’ and ‘storytelling science’ understands the idea of a story. There are of course different definitions of ‘a story’. A primary definition would be: “A character who wants something and is willing to overcome conflict in order to get it”. (Miller 2017); or “A dynamic escalation of conflict-driven events that cause meaningful changes in a character’s life” (Mckee & Gerace 2018).

Essential story elements are: 1. Setting (where and when is the story set?). 2. Character (a person or animal or anything personified). 3. Plot (the events that happen in a story; introduction, the increase in the action, a climax, the decrease in the action, and the resolution). 4. Conflict (without conflict the story will have no purpose or trajectory). 5. Theme (Idea, belief, moral, lesson or insight. This theme is the ‘why’ of the story) (Mckee 1997).

A storyline in a film gives it meaningful picture. A film without a story could be packed with a myriad of pieces of exciting information, many of which are without doubt interesting or even curious, but ultimately the film does not paint an evocative picture as a whole (Dobzhansky 1973).

Of course, not all science films should/could tell a story (or include the fundamental elements of a story). For example, interviews with scientists and involved people, and the

presentation of their research do not make a story. A science film should have a story and scientists should be aware that a film without a story does not have the same emotional effect on the audience as a film with a story.

VI. Narrative

Although ‘narrative’ and ‘story’ are often used as synonyms in informal contexts, these two concepts are somewhat different in meaning. A story refers to the content, that is, the events that are being related (story time is the chronological time in which events unfold), while narrative is more concerned with how this content is presented to readers/audience (narrative time is the time it takes for events to be told), (Chatman, 1980; Genette, 1983).

A non-linear narrative is a storytelling device that does not portray the events of a story in chronological order; this may mean a reverse order, going back and forth between past and future events, or even switching between one parallel plot and another. Another possibility is to start in the middle of the story or even at the end, and then travel back to the same point in order to capture the audience’s attention immediately without any need for detailed descriptions (Kim, Bach, Im, Schriber, Gross, & Pfister, 2018).

It comes as no surprise that linear narratives are dominant – due to force of habit – when scientists make films; filmmaking courses have a positive effect by increasing the wealth and variety of patterns employed in science film narratives (Angelone, Soriguer & Melendo 2019a).

There are many non-linear narrative structures that are adequate for scientific narrations, for example:

- ***In media res structures***

In media res means that the film begins in the middle of the storyline rather than at the beginning. For example, the film starts a story in the middle (*before climax-backwards*) or even at the end (*end-backwards*) and then doubles back to the same point.

- ***Parallel and frame structures***

A *parallel* structure refers to two distinctly different yet closely related storylines that occur simultaneously. Similarly, a *frame* structure – also known as an embedded narrative – consists of many smaller stories within the context or timeframe of a larger story. Each of the narratives within the timeframe can usually stand alone but have more meaning when analysed alongside the larger overall story.

VII. Mode

Science films may be documentary or fiction films. Here I focus more on documentary modes because they are more usual. Documentary film modes are the ways in which filmmakers tell their stories and share their knowledge. Films can be separated into six modes according to certain particular traits and conventions (Nichols 2001):

- ***Expository Mode***

The ‘voice of God’ mode makes use of narrations that employ scripted (oral or written) commentaries illustrating or simply accompanying footage. This mode aims to educate its audience and explain its subject matter as a documentary essay. These films focus more on facts, objective information and evidence than on the evocation of emotions.

- ***Observational Mode***

The fly-on-the-wall documentary mode views the truth without comment or involvement. Nothing is staged and what we see is completely natural. This mode implies that the filmmakers, equipment and crew are invisible and are unheeded by the filmed subjects.

- ***Participatory Documentaries***

This mode reflects documentaries in which “the encounter between filmmaker and subject is recorded and the filmmaker actively engages with the situation they are documenting” (Nichols 2001). The filmmakers become an integral part of the film, even though they are supposed to be telling a story objectively.

- *Reflexive Documentaries*

The reflexive documentary mode stimulates audiences to “question the authenticity of documentary in general”. Spectators acknowledge the way a documentary is constructed (the use of the camera, audio and even the editing).

- *Poetic Mode*

The structure of the film is not based on a linear continuity but, rather, arranges shots based on associations, tone and rhythm. The poetic mode is subjective and an abstract representation of reality. Special emphasis is placed on visual imagery; the film is more reliant on colour, tones, sounds and moods.

- *Performative Documentaries*

The performative mode is regarded as the direct opposite of the observational mode. The filmmaker tends to be passionately involved and hence performative documentaries are usually subjective. Rather than setting out to find the truth, the performative mode shows only one side of the truth.

Scientists require a keen awareness of documentary modes if they are to produce compelling films using the appropriate mode for the message they want to convey and for the audience they are targeting (Burns, O'Connor, & Stocklmayer, 2003). For example, the expository mode is especially appropriate for provoking Awareness and Understanding responses. The observational documentary mode generates above all Awareness and Opinion-forming responses. Enjoyment and Interest responses are linked to the poetic mode. The participatory and reflexive modes engender Interest and Opinion-Forming responses. The Performative mode leads to Enjoyment and Opinion-Forming responses (Angelone, Soriguer & Melendo 2019b). ‘*Scientists-as-filmmakers*’ may aim to provoke with their films one or more of the AEIOU responses in viewers.

VIII. Length

The length of the film (minutes) depends on many factors including: 1. Context; e.g. film festivals screen short films lasting less than 20 min and feature films longer than 50 minutes. Films on the Internet should be very short, usually less than five minutes and ideally less than three minutes. Seminar and science café are more flexible. 2. Content of the film; e.g. the story and the narration themselves. 3. Time available for the scientists. 4. Budget.

Scientists could prepare from the same material films of different lengths according to their needs, i.e. a short version for a film festival, a very short version for on-line use, and a long version for seminars and the classroom.

IX. Quality and style

“Among the many limitations of the deficit model of science communication is its inability to account for the qualities of communication products that arise from creative decisions about form and style” (Mellor, 2018). Quality is a crucial issue and an important challenge for contemporary science communication; style is key when addressing these challenges (Bucchi, 2013). Bucchi states that “Public communication of science should now be mature enough to pass from a ‘heroic phase’, in which ‘everything goes’ for the sake of communicating science, to a phase in which quality is the central concern for all parties involved”. The concept of style enables us to tackle the issue of quality in science communication without imposing either uniformity or any ‘best’ or ‘most appropriate’, ‘one-size-fits-all’ model of science/public interaction. Hence, it is important that science films are made with quality and style.

Style can be divided into two categories:

- **Storytelling style**

For instance, the choice of the documentary mode could be related to the goal of the film (audience responses) but could also be simply a question of style. The same applies for the narration (lineal and non-lineal) and personal engagement.

- **Technical style**

For instance, framing style, camera movement, depth of field, focal lengths, interview style, sound design, and so forth.

To learn more about storytelling and technical styles, scientists should attend filmmaking courses (Angelone 2019).

X. Film concept presentation

If you ask a scientist-filmmaker, ‘what is your film about?’, many will reply with an aimless narration detailing everything they want to film or want the audience to see. However, it is essential to know how to make a concise and compelling presentation of a film. A good film pitch is crucial for obtaining finance or for selling a story to producers and backers and also for increasing the chances that a film be screened (science journal, film festival, seminar, science café, and so forth). We also need to be able to explain our films to the people involved (crew) and audience (scientists, media, policymakers, managers, NGOs and public) to make them want to watch the film.

For a good film presentation, I suggest the following tools:

- **Word Template**

Olson (2015) suggested a Word Template for finding the central theme of the film. The One Word that is at the core of it all. He dubbed it the “Dobzhansky Template” because it is an adaptation of a famous quote from Theodosius Dobzhansky (1964), “Nothing in biology makes sense except in the light of evolution.” Olson took Dobzhansky’s quote in the direction of ‘finding the narrative’, which is basically seeing the forest for the trees. “You need to be able to stand back and look for overriding patterns and not get caught up with the noise.” (Olson 2015). Dobzhansky’s quote becomes a template “Nothing in _____ makes sense except in the light of _____.” This becomes the message of your film, enabling you to

engage in messaging more effectively. “Nothing in *my film* makes sense except in the light of _____.”

- **Logline**

A logline is a one- (or occasionally two-) sentence description that breaks the script down to its essential dramatic narrative in as succinct a manner as possible. A logline is the DNA of your film. A logline must have protagonists, their goals and the antagonist/antagonistic force. Characters are used with adjectives to give them a little depth (Snyder 2005).

- **Half-Life Your Message**

The 3-minute Half-Life Your Message exercise consists of “iteratively shaping a single, core message by progressively compressing a self-imposed time constraint during a spontaneous oral presentation” (Aurbach et al. 2018). A communicator, during a Half-Life Your Message, first takes 60 seconds to speak aloud with no prior preparation on a subject of interest (in this case, our science film). Immediately, the communicator starts again and communicates the same core message but this time in only 30 seconds. The process is repeated in additional iterations with 15 seconds and 8 seconds (Aurbach et al. 2018). The Half-Life Your Message is useful not only for finding the core message of the film but also as preparation for presenting a film in limited period of time.

This paper is not about filmmaking technics but is, rather, a description of the first steps required to familiarize scientists with the peculiarities of science communication via films. It is about how to develop science film stories, narrations and the modes that fit with the desired contexts, audiences and goals of the scientists. Scientists may learn more about filmmaking techniques by attending one of the science filmmaking courses that universities and scientific institutes are now increasingly running (Angelone 2019).

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The author declares no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Table 1. Issues to be considered before scientists make their own films or collaborate with professional filmmakers.

Context	Audience	Goal	Personal engagement	Story	Narrative	Mode	Length	Style	Concept presentation
Science Journal	Scientists	A (Awareness)	Pure scientist	With a story: including main story elements; e.g. Setting, Character, Plot, Conflict, Theme	Lineal	Poetic	Up to context, content, budget, audience	Storytelling style	One-Word-Template
Classroom	Media people	E (Enjoyment)	Science arbiter			Before climax-backwards		Expository	Technical style
Seminar/Conference	Policy-makers	I (Interest)	Honest broker of policy alternatives	Non-lineal	end-backwards	Observational			Half-Life your Message
Science café	Managers	O (Opinion-forming)	The issue advocate		Parallel	Participatory			
Film festival	Non-scientists	U (Understanding)			Frame	Reflexive			
Commercial cinema	Public				Performative				
Internet				No story					

V. Supplementary material/Material suplementario

(Tesis como compendio de publicaciones: Se podrán añadir otras aportaciones científicas derivadas directamente de la tesis doctoral aunque no hayan sido aceptadas ni publicadas en las mismas condiciones anteriormente expuestas.)



Photography from the workshop 'Storytelling Science at Locarno Film Festival', Locarno 2018

Here we present short descriptions about the different workshops that we developed to collect our data:

- 1. Filmmaking for Scientists**
- 2. Science Filmmaking Marathon**
- 3. Storytelling & Storyboarding Science**
- 4. Video-Journalism for Scientists**

1. Filmmaking for Scientists



Photography from the workshop ‘Filmmaking for Scientists’, Lausanne 2018

A major challenge for scientists is to communicate complex concepts and detailed content in ways that are appropriate for a wide audience. Films are powerful tools of communication and can be used in a number of different scientific contexts: for example in ethnographic research, for multimedia theses and the public thesis defence, in outreach, or to bring the general public into closer contact with scientific research. Hence scientists can benefit from the inspirational, educational, and motivational power of audio-visual productions to communicate their ideas and results.

The technical skills for filming and editing, as well as developing a strong narrative, mostly lie outside the training as academic scientists. In this workshop, participants learn about camera, audio- and lighting equipment, how to use film-editing software, together with how to write, design and carry out the basics of making a documentary. This practice-focused workshop includes filming short documentaries.

Workshop content

- Camera and lighting (using DSLR, mirrorless, and cinema cameras).
- Screenwriting and storyboard (using examples from fiction and documentary films).
- Film editing (using industry standard software).
- Filming a short documentary film. The topic of the short documentary film can be freely chosen by the participants and is assisted by the trainer.

Learning outcomes

After this workshop, participants are able to produce short films about their own research or any other subject with professional-level audio- and video quality. Their approach is professionalised in that they are capable of planning their productions by using script and

storyboard, using professional camera and lighting equipment, as well as editing their footage using the best programs.

Organizers

Life Science Zurich (Zurich University and ETH-Zurich), Basel University and CUSO (Universities of Geneva, Lausanne, Fribourg & Neuchatel)

Selected making of from the filmmaking for scientists workshops

<https://vimeo.com/108345838>

2. Filmmaking Marathon



Photography from the workshop ‘Filmmaking Marathon’, Lausanne 2018

The Filmmaking Marathon allows 40 participants (mainly PhD students from Swiss Universities and Research Centres) to learn filmmaking by producing short films with professional filmmakers.

This 4-day Filmmaking Marathon includes

- Short introduction to/review of camera, audio, lighting equipment, editing software, as well as the basics of how to write, design and carry out the making of a documentary that is attractive to a broad audience.
- Participant scientists are joined by filmmakers and artists to work together and prepare short films.
- A selection of the films resulting from the Filmmaking Marathon are screened at the Global Science Film Festival.

Organisers

This workshop is co-organized by universities of Zurich, Geneva, Lausanne, Fribourg & Neuchatel, ETH Zurich, WSL, EAWAG and Zoo Zurich.

See details about the last Filmmaking Marathons and the resulting films here

www.sciencefilm.ch/marathons

Making of from the previous workshops

<https://vimeo.com/209630931>

3. Storytelling & Storyboarding Science



Photography from the workshop ‘Storytelling Science at Locarno Film Festival’, Locarno 2019

The workshop seeks to challenge, inspire and train scientists to use narrative techniques and strategies employed in film to produce persuasive presentations and publications. Good scientists do good science, but great scientists are also great storytellers!

I. Borrowing communication strategies and techniques from film can help in preparing persuasive presentations and publications, and scientists are wise enough to do so! However, filmmaking skills lie outside of the training of the academic scientists. In this workshop, scientists learn storytelling, script writing and storyboarding. This helps them engage audiences by incorporating narrative attributes into their teaching, divulgations and publications.

II. The desire of scientists to communicate elegantly with the general audience using storytelling, and the tireless search of filmmakers for good stories to tell, demand tight collaboration between scientists and filmmakers. Hence, the successful collaboration requires that scientists acquire the basic knowledge of film storytelling and storyboarding. This allow them to translate their research into elegant and convincing cinematographic stories, thus enhancing the communication between them and filmmakers, and making it easier for the filmmaker to transform these stories into films.

Program Information

1. Theory: Storytelling, storytelling technique, film genre, script, storyboarding, and theory of film editing.
2. Practice: Attending the Global Science Film Festival or Locarno Film Festival.

Scientists have the opportunity to watch films and discuss their storytelling techniques with professional filmmakers.

Organizers

Universities of Zurich, Geneva, Lausanne, Fribourg & Neuchatel, ETH Zurich.

See details about the last Storytelling Science here

<https://naturwissenschaften.ch/service/events/95802-storytelling-storyboarding-science>

Selected making of from the previous workshops

<https://vimeo.com/284984815>

3. Video-Journalism for Scientists



Photography from the workshop ‘Video-Journalism for Scientists at Vision du Réel Film Festival’, Nyon 2019

Workshop description

Video-journalism is one of the most rapidly expanding and exciting developments in the field of science communication. Unfortunately, video-journalism lies outside the training of the science academies. In this workshop, we seek to challenge, inspire and train a new generation of scientists to find innovative, creative and journalistic ways of reporting science through film. Video-journalists, the jack-of-all-trades, have many tasks, including pitching, developing and researching stories, producing, shooting and editing videos.

Workshop content

I. Theory and practice

Science journalism

Stories: pitching, developing and researching

Production of low-budget films

Screenwriting and storyboarding

Camera, lighting and audio

Film editing

II. Workshop projects (Video-reports)

After finishing the workshop, participants are given the possibility (however not mandatory) to produce their own video-reports (2-10 minutes long) in 2 months. During this period they could ask for help and support from the trainer.

Learning outcomes

At the end of the workshop, participants will be able to prepare their own video-reports, including script & storyboard, camera & lighting and editing.

Organizers

Universities of Basel, Geneva, Lausanne, Fribourg & Neuchatel.

Selected making of from the previous workshops

<https://vimeo.com/329636265>

VI. General Conclusions/Conclusiones Generales

(Tesis como compendio de publicaciones: Conclusiones Generales, en las que se resalten los avances, aportaciones y progresos científicos que la tesis, en su caso, comporte ‘indicando de qué publicación o publicaciones se desprenden’.)



Photography from the workshop ‘Storytelling Science at Locarno Film Festival’, Locarno 2018

General Conclusions

Universities and scientific institutes in Switzerland are promoting a new generation of ‘*scientists-as-filmmakers*’. These experiences could help other countries design specific programs for training scientists in science-film-making.

The new generations of ‘*scientists-as-filmmakers*’ make a clear break from linear narrative structures in favour of other more varied structures, which will increase the wealth of patterns in science film narratives.

It is vital that the new generation of ‘*scientists-as-filmmakers*’ is trained to understand and use different documentary modes. This will help this new generation to produce a much greater variety of documentary modes.

The educational lessons from the first edition of the Global Science Film Festival could help scientists and scientific institutes worldwide create their own science film festivals.

Based on traits and conventions, we detected five identity modes in the realm of environmental film festivals, namely 'name', 'timing', 'public', 'film' and 'organization'. Even though each of the environmental film festivals has its own unique complex identity, general patterns of identities can be discerned. The identity modes presented in this thesis could help existing environmental film festivals (and generally speaking, science film festivals) improve their strategies and to have better coordination between them.

When scientists prepare their own films or collaborate with professional filmmakers, they should ensure that science film stories, narrations and modes match with the desired contexts, audiences and goals of science films.

Conclusiones Generales

Universidades e institutos científicos suizos están promocionando una nueva generación de '*científicos-cineastas*'. Estas experiencias podrían ayudar a otros países para diseñar programas específicos, que sirven para entrenar sus científicos en 'hacer films para científicos'.

La nueva generación de '*científicos-cineastas*' hace una ruptura clara de las narrativas lineales a favor de estructuras narrativas mas variables, lo cual aumentará la riqueza de patrones narrativos de films científicos.

Es vital que la nueva generación de '*científicos-cineastas*' esté capacitada para comprender y utilizar diferentes modos documentales.

Las lecciones educativas de la primera edición del Global Science Film Festival ayudarán a los científicos y los institutos científicos, de todo el mundo, para crear sus propios festivales de cine de ciencia.

Basado en atributos y criterios comunes, hemos detectado cinco modos de identidades en el género de los festivales de cine ambiental; 'nombre', 'tiempo', 'público', 'film' y 'organización'. A pesar de que cada uno de los festivales de cine ambiental tenga su identidad única y compleja, patrones generales de identidades se discernieron. Los modos de identidades presentados en esta tesis doctoral podrían ayudar a los festivales de cine ambiente (y en general los festivales de cine científico) existentes a mejorar sus estrategias y tener una mejor coordinación entre ellos.

Cuando los científicos preparan sus propios films, o colaboran con cineastas profesionales, deben asegurarse que las historias, las narraciones, y los modos de los films científicos coincidan con los contextos, audiencia y objetivos deseados de los films científicos.

VII. Summaries/Resúmenes

(Tesis como compendio de publicaciones: Resúmenes en español y en inglés o, en su defecto, en el idioma habitual para la comunicación científica en su campo de conocimiento científico, técnico o artístico.)



Photography from the 'Global Eco Film Festival', Zurich 2017

Resumen del Capítulo 1

Una nueva generación de '*científicos-cineastas*': Experiencias adquiridas en Suiza



Photography from the workshop 'Filmmaking Marathon', Lausanne 2018

Una de las herramientas más potentes para la comunicación de la ciencia, sea para los mismos científicos o para el público en general, son los films. Recientemente ha habido una explosión en la demanda de films científicos. Para satisfacer este mercado, universidades e institutos de investigación están, de forma creciente, enseñando a sus científicos y estudiantes cómo producir sus propios films a través de cursos acreditados 'hacer films para científicos', como una parte de los programas de comunicación científica. Estos cursos de 'hacer films para científicos' están produciendo una nueva generación de '*científicos-cineastas*'. Una generación que definimos como "científicos que asumen la dirección de films como una parte de su formación académica, aunque de una forma no profesional". El objetivo de este artículo es i) documentar y describir la emergencia de esta nueva generación de '*científicos-cineastas*', y ii) clasificar y analizar, usando atributos y criterios comunes, los cursos de 'hacer films para científicos' ofrecido, sobretodo, por universidades e institutos de investigación suizos. Este estudio podría promocionar la nueva generación de '*científicos-*

cineastas’, y ayudar otros países a diseñar programas específicos en ‘hacer films para científicos’ por sus científicos.

Resumen del Capítulo 2

Los cursos de ‘hacer films para científicos’ ayudan a enriquecer las narrativas de los científicos



Photography from the workshop ‘Filmmaking for Scientists’, Zurich 2015

Contexto

Los científicos tienen la tendencia de comunicar sus hallazgos científicos mediante estructuras narrativas cronológicamente lineales, divididas por las secciones comúnmente conocidas: Contexto/Antecedentes, Métodos, Resultados y Discusiones (Introduction, Methods, Results and Discussions; IMRAD). Teniendo en cuenta la naturaleza de las publicaciones y presentaciones científicas, esta tendencia de narrativa lineal es comprensible. De la misma forma, la narrativa lineal es dominante, por inercia, cuando los científicos hacen films de sus investigaciones. No obstante, eso no debería ser el caso de la nueva generación de ‘científicos-cineastas’. Una generación que “asimile la producción de films como una parte de su formación académica, aunque de una forma no profesional”, ya que esta generación está formada para apreciar y aplicar estructuras narrativas alternativas. El objetivo de este artículo es entender y predecir cómo los cursos de ‘hacer films para científicos’ podrían afectar las

estructuras narrativas de los futuros films producidos por la nueva generación de '*científicos-cineastas*'.

Métodos

Hemos evaluado las estructuras narrativas de 102 científicos de nueve universidades y centros de investigación suizos. Antes y después de asistir a los cursos de 'hacer films para científicos', los participantes respondieron a un cuestionario sobre sus posibles estructuras narrativas a la hora de hacer los films. En los cursos de 'hacer films para científicos', los participantes aprendieron diferentes estructuras narrativas alternativas, que pueden implementar al hacer sus films, específicamente: 'final-hacia atrás', 'antes del clímax-hacia atrás', 'paralelo' y 'marco'.

Resultados

Antes de los cursos de 'hacer films para científicos', el 94.1% de los participantes contestaron que usarían la estructura narrativa lineal en sus films, el resto de los participantes optarían por una de las otras estructuras narrativas alternativas (no lineales). Después de hacer los cursos, el número de los usuarios potenciales de la narrativa 'lineal' disminuyó casi once veces, y por lo tanto esta narrativa se convirtió en la narrativa menos popular. En cambio, después de los cursos, la narrativa 'antes-clímax hacia atrás' experimentó setenta y nueve veces más incremento en el número de los posibles usuarios. Las narrativas 'paralelo', 'marco' y 'final-hacia atrás' tuvieron siete, seis, y cuatro veces de aumento, respectivamente. Los cursos de 'hacer films para científicos' no solo afectaron la elección de las estructuras narrativas (desplazamiento de la 'lineal' hacia las narrativas alternativas), sino que también produjeron un gran incremento en el número de las estructuras narrativas que los participantes usarían.

Conclusión

El estudio destaca la importancia de los cursos de 'hacer films para científicos' que las universidades e institutos científicos ofrecen a sus estudiantes para prepararlos para producir

sus propios films. Estos cursos tienen que tener entre sus objetivos enseñar a los científicos cómo apreciar y aplicar estructuras narrativas no lineales en sus narrativas científicas. Al hacerlos, la nueva generación de '*científicos-cineastas*' rompe la inercia de la narrativa lineal hacia narrativas alternativas, y enriquece los patrones de las narrativas de los films científicos.

Resumen del Capítulo 3

Los modos de los documentales producidos por la futura generación de '*científicos-cineastas*'



Photography from the workshop 'Filmmaking Marathon', Lausanne 2018

Contexto

Los modos (o modalidades) de los documentales son un esquema conceptual que clasifica los documentales a base de atributos y criterios comunes. Se reconocen seis diferentes modos de documentales: 'poético', 'expositivo', 'observacional', 'participativo', 'reflexivo' y 'performativo'. Por inercia, los científicos no entrenados en la producción de documentales generalmente usan el modo expositivo, ya que este modo posee los mismos atributos y criterios que las narrativas científicas (p. ej. artículos científicos y presentaciones). Ahora bien, esto no tiene que ser el caso de la nueva generación de '*científicos-cineastas*'. Una generación que 'asimile la producción de films como una parte de su formación académica, aunque sea de una forma no profesional', ya que esta generación está entrenada a apreciar y aplicar los otros modos de documentales.

Métodos

En este estudio hemos encuestado a 102 científicos de nueve universidades e institutos de investigación suizos, preguntando sobre los posibles modos de documentales que producirían. Antes y después de participar en los cursos de ‘hacer films para científicos’, que incluyeron enseñar los seis modos documentales, los participantes respondieron a un mismo cuestionario sobre sus modos documentales preferidos.

Resultados

Como era de esperar, antes de los cursos, la mayoría de los 102 participantes (83.33%) optó por usar el modo expositivo, mientras el 27.45% utilizó el modo observacional. Solo unos pocos optaron por los modos participativo y poético. Después de asistir a los cursos de ‘hacer films para científicos’, el número de participantes interesado por el modo expositivo descendió a casi la mitad, mientras el número de participantes que optaron por usar el modo observacional casi se duplicó. Tras atender a los cursos, de forma inesperada, el modo más elegido fue el poético (70.45%), seguido por el modo participativo (38.23%) y reflexivo (17.64%). Los cursos de ‘hacer films para científicos’ no solo afectaron los modos documentales elegidos, sino también aumentó el número total de los modos documentales que los participantes considerarían.

Conclusiones

Es vital que la nueva generación de ‘científicos-cineastas’ esté formada para comprender y utilizar los diferentes modos documentales, a la hora de comunicar su ciencia a través de films, sea para sus pares científicos, o para el público en general. Los films producidos por una bien preparada futura generación de ‘científicos-cineastas’ tendrían mayor variabilidad de los modos documentales utilizados.

Resumen del Capítulo 4

La creación de nuevos festivales de cine científico: Lecciones ‘detrás de la escena’ del Global Science Film Festival



Photography from the ‘Global Science Film Festival’, Zurich 2017

Los documentales son herramientas potentes para las comunicación científicas, ya que permiten a los científicos comunicar sus investigaciones de forma mas eficiente, tanto para otros científicos como para el público en general. Debido a la proliferación de documentales científicos, en las últimas décadas, la creación de nuevos festivales de cine científico ha aumentado mundialmente. Sin embargo, el camino para crear nuevos festivales de cine científico está lleno de muchos obstáculos. El mayor desafío es la carencia de experiencias en la organización de festivales de cine, lo cual está fuera de la formación académica de los científicos. Desgraciadamente, las experiencias adquiridas durante la creación de festivales de cine científico nunca han sido compartidas dentro de la comunidad científica. Este artículo representa las primeras lecciones ‘detrás de la escena’ con las experiencias de crear festivales de cine científico, usando como ejemplo el Global Science Film Festival. Las experiencias aprendidas (i. nombre del festival, logo y premios, ii. tiempo, duración y localidad, iii. programa de documentales, iv. el público, v. organizadores, patrocinadores, financiadores y colaboradores, vi. voluntariados, vii. jurado, viii. eventos paralelos, ix. presupuesto, y x. cómo

atraer el público) serían de gran ayuda para científicos e institutos científicos que quieren establecer sus propios festivales de cine científico, a nivel mundial.

Resumen del Capítulo 5

Buscando identidades en el género de los festivales de cine ambiental



Photography from the workshop 'Filmmaking for Scientists', Munich 2018

Contexto

Los festivales de cine ambiental están floreciendo mundialmente. Desafían, inspiran y motivan a la gente, animándolos a salir de sus hogares y a intentar hacer cambios en el mundo. Hasta ahora, a pesar del crecimiento en los números de los festivales ambientales, ningún estudio ha tratado de identificar y analizar los modos (modalidades) que estos festivales aplican.

Material y métodos

Basándonos en los atributos y criterios de 64 festivales de cine ambiental, hemos clasificado y analizado los modos de identidades que les agrupan. Los análisis están basados en los datos recogidos, principalmente, mediante cuestionarios completados por los propios organizadores de los festivales de cine ambiental.

Resultados

A pesar de que cada festival de cine ambiental tiene sus propios modos de identidades (nombre, tiempo, público, films, y organización), emergieron unos patrones e identidades generales. Estos patrones que se han identificado no son categorías o mapas de rutas para los festivales de cine ambiental, sino más bien, son simplemente atributos y criterios generales, comunes a otros muchos festivales de cines.

Conclusiones

Los modos de identidades discutidos en este artículo podrían ayudar a los festivales de cine ambiental existentes a mejorar sus estrategias. La coordinación (nombre, tiempo, y selección de los films) entre los festivales de cine ambiental debería beneficiarse de los modos de identidades descritos en este artículo. Es más, estos modos son indudablemente vitales para la creación de futuros festivales de cine ambiental, que deberían tratarse con los diferentes modos de identidades, sean la organización y patrocinio, así como el nombre, tiempo, duración y el público, o la elección de los films.

Resumen del Capítulo 6

Que tienen los científicos que saber antes de hacer films?



Photography from ‘Storytelling & Storyboarding Science’ at Locarno Film Festival 2019

La demanda de los films científicos está aumentando. Los científicos hacen los films en una forma no profesional ‘*científicos-cineastas*’, o en colaboración con cineastas profesionales. Desde nuestra propia experiencia – enseñado a los científicos como hacer films, hacienda films científicos y trabajar como jurado en festivales de cine científico – aprendimos que los científicos deben de estar familiarizados con ciertas peculiaridades relevantes de los films científicos antes de que hagan sus propios films o colaboren con cineastas profesionales. Los numerosos ejemplos de films científicos “fallados” hechos por científicos y las muchas horas perdidas de malentendidos entre los científicos y los cineastas profesionales nos motivó para escribir este artículo. Este manuscrito no es sobre las técnicas de hacer films, mas aun, es sobre ciertas peculiaridades de la comunicación de ciencia a través del film, que todos los científicos deben de asimilar antes de que se metan en el mundo de hacer films. Este artículo va sobre como asegurarse que las historias, las narraciones y los modos de los films

científicos se encajan con los deseados contextos, audiencias y objetivos de los films científicos.

VIII. References/Referencias bibliográficas

(Tesis como compendio de publicaciones: Referencias bibliográficas, documentales y de otra índole exigidas por cada campo del saber. Se podrán presentar conjuntamente o por capítulo/trabajo presentado.)



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IX. Impact factor/Factor de impacto

(Tesis como compendio de publicaciones: Informe con el factor de impacto y cuartil del Journal Citation Reports (SCI y/o SSCI) o de las bases de datos de referencia del área en el que se encuentran las publicaciones presentadas.)



Photography from the 'Global Science Film Festival', Zurich 2017

Chapter 1

Angelone S (2019) A new generation of '*scientists-as-filmmakers*': experiences gained in Switzerland. *Science Communication* 41(3): 369-377.

Science Communication has 2.032 Impact Factor and it is listed in SCImago in the first quartile for Sociology and Political Science. The H Index is 46.

Chapter 2

Angelone S, Soriguer RC, Melendo A (2019) Filmmaking courses for scientists help promote richer alternatives to chronological narratives. *Studies in Higher Education*. DOI: 10.1080/03075079.2019.1604651

Studies in Higher Education has 2.321 Impact Factor and it is listed in SCImago in the first quartile for Education. The H Index is 80.

Chapter 3

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Chapter 4

Angelone S, Melendo A, Hall M (2019) The creation of science film festivals: lessons from behind the scenes at the Global Science Film Festival. Educational Media International. (Under Review)

Educational Media International has 0.77 Impact Factor and it is listed in the second quartile in Social Sciences. The H Index is 17.

Chapter 5

Angelone S, Capizzi G, Hall M, Soriguer RC, Melendo A (2019) Searching for identities in the realm of environmental film festivals. Film International. (Under Review)

Film International is listed in the fourth quartile in Social Sciences. The H Index is 2. Film international is one of the most prestigious journals in the field of films and film festivals.

Chapter 6

Angelone S (2019) What should scientists know before making films?. Science Communication. (Under Review)

Science Communication has 2.032 Impact Factor and it is listed in SCImago in the first quartile for Sociology and Political Science. The H Index is 46.