

Chapter 4

Attempts to Categorize and Evaluate Science Festivals, a 30-Year-Old Science Communication Event: The Case of Greece



Elpiniki Pappa and Dimitrios Koliopoulos

Abstract Science festivals have their roots in the annual conference of the British Association for the Advancement of Science, which was founded in 1831 and later renamed the British Science Festival. The modern concept of a science festival, as we know it today, first emerged in Edinburgh, Scotland, in 1989. The prevalence of science festivals has grown dramatically within the past decade, cementing their status as a global phenomenon. Between them, they share a few common characteristics of transiency, a high level of public engagement, a time-limited nature and a heterogeneous target group. However, they do not constitute a uniform set of events, as different kinds of science festivals have thus far been developed. This chapter aims to review the notion of science festivals and highlight their diversity and main characteristics. Special attention is paid to science festivals in Greece. Moreover, a brief overview of recent research data, as well as an overview of the limitations of existing studies in the field of science festivals' evaluation, is presented. Subsequently, a theoretical and methodological framework for the study of science festival activities' analysis, design and evaluation is proposed. Finally, suggestions for future research in the field of science festivals are discussed.

Keywords Science festival · Science communication · Scientific knowledge transformation · Evaluation of science festival events

4.1 Introduction

The origins of science festivals can be traced back to 1831, to the annual conference of the British Association for the Advancement of Science, which has since been renamed the British Science Festival (BSA n.d. a). Between the 1980s and 2000s, the British Science Festival was transformed from a meeting where the major scientific

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advances were announced into a medium for science communication using innovative activities to disseminate scientific knowledge to the general public. The activities included in this event are characterized by means of communication that are entertaining and familiar to the public. A few examples of such events are ‘evening science meets arts’ and theatre performances, as well as activities for schools, families and broader community audiences (BSA n.d. a).

The popularity of these events started to increase in the 1990s, but the Edinburgh International Science Festival in 1989 was the first science festival with modern characteristics (Cassidy 2006). According to research conducted in 2008 and 2009, almost half of the 56 science festivals included in the survey were founded between 2006 and 2009 (Bultitude et al. 2011). During the twenty-first century, science festivals have gained an important position in public life and have evolved into a key tool for science communication and public engagement with science. A closer look at their impact on the science–society interface shows that the festivals have previously been recognized as a ‘prevailing mode of science communication’ (Kim 2007:307) and a ‘vital instrument for intervention’ within the ‘dimension of the scientific culture’ (Quaranta 2007:5).

The first half of this chapter presents the significant diversity of such events and subsequently proposes a categorization pattern based on six principal characteristics of science festivals. Greece’s example is used as a case study, and a description of the evolution of science festivals over the years follows. In the second half of this chapter, current studies on the field of science festival evaluation and their limitations are reviewed. Furthermore, given the existing gap in systematically evaluating science festivals, a coherent theoretical framework is suggested. The authors propose that the establishment of such a theoretical model would facilitate the development of methodological tools for the analysis, design and evaluation of science festival activities and aid in answering current related research questions.

4.2 The Case Study of Greece

4.2.1 *Historical Background*

In Greece, science communication first appeared in the late twentieth century, when museums’ educational activities started to familiarize young people and the general public with scientific subjects. Research institutes became involved in science outreach activities for the first time in 1993, when the National Hellenic Research Foundation (NHRF) organized a science communication programme called Science Society, aiming to disseminate scientific knowledge to the general public.¹ Indicatively, in the period from 1993 to 2008, the NHRF carried out 89 lecture cycles in

¹ Information retrieved from an informal interview conducted with the head of Educational and Outreach Events, Science Society of the National Research Foundation, for the years from 1993 to 2013.

which more than 750 researchers, distinguished scientists and artistic and literary personalities from Greece and abroad participated as speakers (Science in Society 2010). From 2000 onward, the General Secretariat for Research and Technology also created several science and technology awareness initiatives, including Science and Technology Week. During that time, research centres, scientific associations, museums and educational institutions also began organizing their own science awareness events, such as public talks, science cafés, interactive exhibitions and screenings of scientific films.²

A few years later, in 2006, the Natural Sciences and Technology Fair was launched by a secondary school structure and the Hellenic coordinating committee of Science on Stage—Europe (Tsitopoulou-Christodoulidi 2007). In this well-established yearly event, school students and their teachers participate by presenting scientific and technologically related projects to their peers and the general public. The term ‘science festival’ was introduced into the Greek national consciousness only in 2011, when the NHRF, in collaboration with the British Council, organized the first Festival of Science and Technology at its facilities. According to the organizers, the aim of this event was ‘to familiarize young and older people with the concepts, methodologies and secrets of scientific thoughts as well as applications of research in everyday life’ (NHRF 2011).

However, the first well-established science festival was founded in 2014. The Athens Science Festival (ASF) is organized annually by the educational organization Science Communication (SciCo), the British Council and the Technopolis of the City of Athens, with the invaluable contribution and participation of more than 120 academics as well as research and educational institutions. The ASF is conducted under the auspices of the Ministry of Education and Religious Affairs and the General Secretariat of Research and Technology. During this five-day event, 15 main scientific fields are represented through a plethora of activities, including kids’ labs, workshops, science cafés, talks, art exhibitions, live experiments, performances and the interactive exhibition, which is the main and most frequently visited activity of the festival. It is estimated that 120,000 visitors have attended the event over the past six years, and that students account for a quarter of the total visitor numbers. The number of visitors is an approximation reached by an internal evaluation carried out by the festival’s organizers every year. More specifically, during all five days of the event, the visitors who enter the venue are counted by volunteers using clickers. The numbers of school students visiting the ASF, however, are more precise since they are derived from detailed booking lists created by the organizers for operational purposes. Due to the success of the event, similar festivals have been founded by SciCo in other cities of Greece and in Cyprus as well (ASF n.d.).

The budgets and funding models of science festivals vary from one event to another and depend mainly on the size of the event. The executive director of the ASF, who is also a member of SciCo, provided us with some context regarding the budget and funding sources needed in order to organize and implement a science festival. Among

² ‘Science in society’, Innovation, Research and Technology, 2010, 78:18–22, <http://www.ekt.gr/el/magazines/15847> (in Greek).

the science festival events organized by SciCo, the ASF is the biggest, attracting visitors and participants from all over Greece and abroad. Its cost is estimated at €70–100,000 and is covered by a variety of sources: 40% by revenue derived from ticket purchases, 30% by sponsorships and 30% by organizers' resources. On the other hand, the cost for a local event organized by SciCo is estimated at €30–40,000; there is no ticket fee for the visitors, and the expenses are exclusively covered by the organizers and sponsors at 70% and 30%, respectively. For example, in the case of the Thessaly Science Festival, the budget was mainly covered by the University of Thessaly, while the Patras Science Festival was funded primarily by the Hellenic Open University.

4.2.2 Attempts to Categorize Science Festival Events

The term 'science festival' refers not to a specific activity but is rather used as an umbrella term. Science festivals are temporary events, lasting from one day to one month and include a wide range of activities (scientific lectures, exhibitions, workshops, live demonstrations of experiments, panel discussions, hands-on activities and more) (Rose et al. 2017). Unlike other science communication and educational forums, science festivals are interactive in a way that allows children to interrelate with STEM (science, technology, engineering, mathematics) professionals and also allows adults to ask questions directly of scientists (Rose et al. 2017). Moreover, science festivals differ from activities offered at science museums and centres because of their time-limited nature and their focus on current scientific research (Jensen and Buckley 2014). Science festivals appeal to a variety of audiences by offering them the opportunity to explore numerous scientific topics and activities with just one visit (Durant 2013). A common principle of most festivals' activities is that they combine science with fun and entertainment (Kennedy et al. 2017). The main goal of such events is to foster positive attitudes towards science, educate participants and build relationships between science institutions and the community (SFA n.d.).

Although there is not a widely accepted definition of a science festival, we employ Bultitude and colleagues' characterization (Bultitude et al. 2011) of a science festival as having the following qualities:

- It has as its focus the 'celebration' of science, technology, engineering, and related aspects.
- It aims to engage non-specialists with scientific content.
- It has a time-limited nature and reoccurs annually or biennially.

A systematic science festival categorization has been attempted by a few research teams (such as Bultitude et al. 2011; EUSCEA 2005). This paper offers an overview of the wide science festival spectrum with six principal characteristics of those events: main objectives; venue type; organizations involved in managing and delivering the event; activities' facilitators; target audience; and science communication activities' formats. Table 4.1 categorizes science festival examples taking place in Greece. The

Table 4.1 Categorization of examples of Greek science festivals

Science festival events for the general public		Athens science festival		Patras science festival		Thessaly science festival		Kallithea festival of science, technology and environment		Science and technology festival	
Examples of Greek science festivals	Pint of science festival	Researchers night	Festival of science and technology								
Main objectives	Inform about the latest scientific research in an accessible way	Familiarize with scientific world and latest science research occurring in Greece	Familiarize with scientific world and research application in everyday life	Introduce the latest scientific and technological advancements in an entertaining way, link everyday life to science, encourage young people to consider a science-related career				Familiarize with the world of science	Aware about scientific and technological topics in an entertaining way		
Venue type	Bars	Universities and research centres' premises	Research centre's premises	Hub of cultural events (technopolis)		Selected venues in Patras city centre		Beach	Shopping mall		
Principal organizers	University-based team	Universities, research foundations	Universities, research foundations	Non-profit organization, non-governmental organization, city council		Non-profit university		City council, foundation, company	Company, non-profit organization		
Activities' facilitators	Scientists	Scientists, researchers, university students	Scientists, researchers, science communicators, school students, teachers	Scientists, researchers, university students, school students, teachers, artists, staff of cultural and educational organizations		Scientists, researchers, university students, school educators, artists		School students, scientists, staff of scientific unions and educational foundations	Educational organizations and museums' educational staff		

(continued)

Table 4.1 (continued)

Science festival events for the general public						
Examples of Greek science festivals	Pint of science festival	Researchers night	Festival of science and technology	Athens science festival	Patras science festival	Thessaly science festival
Target audience	Adults	University and school students, educators, families with kids, general public	University and school students, educators, young researchers, families with kids, general public	School students, educators, public	School students, educators, families with kids, adults, general	Families with kids, adults, general public
Main activities	Scientific lectures	Scientific lectures, interactive exhibition, experiment demonstrations	Scientific lectures, debates, workshops, guided tours, science theatre, science films	Interactive exhibition, demonstration, scientific lectures, science café, workshops, science theatre/films/shows, art, star observation	Scientific lectures, café, workshops, science theatre/films/shows, science and art	Scientific lectures, interactive exhibition, experiment demonstrations, star observation, science and art
						Families with kids
						Interactive exhibition, experiment demonstrations

(continued)

Table 4.1 (continued)

School-based science festival events				Mixed-form science festival events	
Fair of natural sciences and technology	Science and technology festival	Natural sciences and technology fair	Lesvos STEM festival	Natural science festival—Syros	Natural science fair
Aware about scientific and technological topics	Aware about the connection of everyday life with the scientific phenomena	Aware about scientific and technological topics	Aware about STEM education and innovation in the natural sciences	Aware about the role of natural sciences in education and society; popularize science	Popularize science
School	School	School	School	School, university's premises, Cyclades Chamber of Commerce	Town hall
School	School	Director of secondary education, EU program	Director of secondary education, scientific union	Director of secondary education, city council	School, city council, scientific union
School students and teachers	School students and teachers	School students and teachers	School students and teachers, university students	Scientists, researchers, educators	School students and teachers, scientists, educators
School students and parents	School students and parents	School students and parents, educators, general public	School students and parents	School students and parents, educators, general public	School students and parents, general public
Interactive exhibition, experiment demonstrations, digital workshops	Interactive exhibition, experiment demonstrations	Interactive exhibition, experiment demonstrations	Interactive exhibition	Scientific lectures, workshops	Interactive exhibition, experiment demonstrations, lectures, workshops, star observation

marked diversity of the festivals' characteristics makes each of them a special case. However, looking more closely at Table 4.1, we can recognize a few patterns that arise and distinguish between three types of science festivals: events for the general public, school-based events and mixed-form events.

In the first category, science festivals are organized by universities or organizations related to non-formal science education and science communication (Bultitude et al. 2011; Jensen and Buckley 2014). In this group of events, audiences and the activities' facilitators can range from school students to scientists, and the events can include a variety of activities. The main objectives and venue types for such events differ among organizers. Indeed, when the main organizer is a university, the science festival usually takes place in the university setting and aims to inform the public about the latest scientific research occurring in the reference country. On the other hand, science festivals organized by other organizations have more broad aims, such as to link everyday life to science and encourage young people to consider science-related careers. In this case, science festivals occur without relation to science venues and are commonly located in the city centre (such as in bars, cultural hubs, shopping malls and so on.).

The second category comprises events that are primarily organized by the school community (such as schools or directors of secondary education) in cases where formal education recognizes the need to introduce non-formal education activities into the curriculum (Koliopoulos et al. 2005; McComas 2011). School-organized science festivals, taking place in a school setting, aim mainly to address pupils and their parents. Their main objective is for students to present scientific phenomena through interactive exhibitions or experimental demonstrations and thus understand the link between natural sciences and everyday life.

In the third category of mixed-form events, science festivals that engage both the school community and the general public are included. Their activities' facilitators are not only school students, but also people related to science (such as scientists). Such events occur out of the school setting and have mixed organizational patterns (for example, a school collaborating with a city council).

Another categorization that can be made is based on science communication activities used in the science festival. The target audiences and formats of diverse science communication activities taking place in a science festival are shown in Fig. 4.1. Each of the activities has a principal target audience (shown on the y-axis, based on the examples of Greek science festivals listed in Table 4.1) and a specific activity format in relation to the degree of its formality (x-axis) based on the activities' format categorization made by EUSCEA (2005). It is worth mentioning that specialized activities are used for different target audiences. For instance, science cafés, debates and lectures are addressed to adult audiences, while interactive exhibitions and demonstrations of experiments mostly target school-aged students and families with kids.

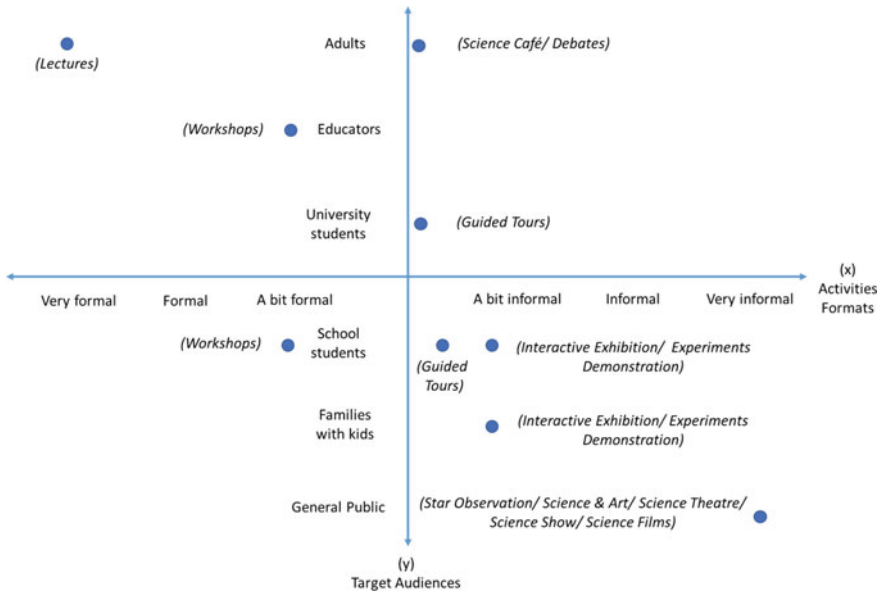


Fig. 4.1 Overview of science festival activities related to their degree of formality (x-axis) and their target audiences (y-axis)

4.3 Attempts to Evaluate Science Festival Events

Most current evaluation efforts attempted in the field of science festivals are based on participant self-reports or on event-generated reports and recommendations (for example, Dundee Science Centre 2016; SFA 2016; British Science Association 2017, 2018, 2019). A few efforts to evaluate science festivals’ social impact have attempted to measure visitors’ attitudes towards science and their learning gains after attending these events, or focused on attendees’ expectations and experiences (for example, DSC 2016; BOP Consulting 2016; SFA 2016; Sardo and Grand 2016; Fogg Rogers 2017; BSA 2017, 2018, 2019).

However, systematic evaluative efforts lag behind (Rose et al. 2017). Most science festival evaluation studies are methodologically limited and are based mainly on closed questionnaires and a self-reporting approach that offer little insight into the impact or value of an activity or science festivals overall (Jensen and Buckley 2014). A few articles about school science festivals (science fairs) report positive and supportive attitudes from participating school students (Abernathy and Vineyard 2001). However, researchers generally agree that most of the articles written about the effectiveness of science fairs are based on opinion rather than on research (Yasar and Baker 2003). After all, very few studies have focused on visitors’ views and have subsequently been published in peer-reviewed journals (Jensen 2011).

Another crucial issue that has not yet been highlighted in contemporary research is the aspect of the design of science festival activities and the transposition of scientific

knowledge taking place in order to create forms of knowledge that are accessible to the public. In Greece, there is research in progress in this field that aims to assess the design of such activities and evaluate their potential cognitive impact on visitors, and particularly on school students.

Considering the lack of a solid theoretical framework for the evaluation of science festivals, it is initially necessary to develop such a framework in order to permit the production of systematic and thorough research data in the field of science festival design and evaluation. We propose that such a theoretical and methodological framework could be based on the intersection of three research fields concerning different perspectives on the diffusion of scientific knowledge:

- (A) The field of *science communication* (Stocklmayer et al. 2001; Schiele et al. 2012), which addresses, among other things, issues of public understanding of scientific knowledge and scientific knowledge diffusion to general audiences. The existing theoretical studies and methodological tools of this field may provide us with data about the popular image of science, its potential, its difficulties, and the limits of science popularization. Moreover, through this field, we can collect valuable information, not only regarding the gap between science and culture, but also about the process of communication as a two-way cross-cultural event. The field of science communication can serve as an ‘epistemological umbrella’, ensuring an epistemologically reliable version of science festival evaluation.
- (B) The field of *science museology* (Guichard and Martinand 2000; Schiele 2001; Achiam and Marandino 2014; Filippopoliti and Koliopoulos 2014), which offers a framework for the communication and transposition of scientific knowledge, in the cases of science exhibitions within science museums and centres. We argue that this framework can be adopted in the case of science festivals, and especially with regard to interactive exhibitions, experiments and demonstration activities. Science museum exhibitions (Triquet 1993) and science festivals’ interactive activities share several characteristics, the most important of which are an aim to not transmit specialized scientific knowledge but rather to promote the scientific literacy of people, in order to understand the everyday world; a mixed and diverse audience; an aim to educate through entertainment; and a presentation of a scene, rather than a simple text-to-knowledge correspondence.
- (C) The field of *science education* (Astolfi and Develay 1989; Lederman and Abell 2014), which investigates, among other things, school students’ cognitive and emotional progress during formal and formal/non-formal interaction educational settings. Consequently, this field may offer fundamental theoretical knowledge and methodological solutions, particularly in the evaluation of school-based science festivals, but also for other forms of science festivals that target school students.

4.4 Epilogue

Despite the fast-paced growth in the numbers and types of science festivals all over the world, and the multi-year effort to assess the impact of such events, research in this field remains in its primary stages. An extensive number of research questions have not yet been adequately investigated, or in some cases, at all. Among the queries looking for answers are the following:

- (A) What are the epistemological and pedagogical conceptions of science festival organizers?
- (B) What is the cognitive impact of science festival activities on the general public?
- (C) What is the potential role of science festivals in formal education settings as extracurricular activities?

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