Scheduling science on television: A comparative analysis of the representations of science in 11 European countries

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1. Introduction

While science-in-the-media is a useful vehicle for understanding the media, few scholars have used it that way: instead, they look at science-in-the-media as a way of understanding science-in-the-media and often end up attributing characteristics to science-in-the-media that are simply characteristics of the media, rather than of the science they see there.

This point of view was argued by Jane Gregory and Steve Miller in 1998 in *Science in Public*. Science, they concluded, is not a special case in the mass media, understanding science-in-the-media is mostly about understanding the media (Gregory and Miller, 1998: 105). More than a decade later, research that looks for patterns or even determinants of science-in-the-media, be it in press or electronic media, is still very rare. There is interest in explaining the media's selection of science content from a media perspective. Instead, the search for, and analysis of, several kinds of distortions in media representations of science have been leading topics of science-in-the-media research since its beginning in the USA at the end of the 1960s and remain influential today (see Lewenstein, 1994; Weigold, 2001; Kohring, 2005 for summaries). Only a relatively small amount of research has been conducted seeking to identify factors relevant to understanding how science is treated by the mass media in general and by television in particular.

The current study addresses the lack of research in this area. Our research seeks to explore which constraints national media systems place on the volume and structure of science programming in television. In simpler terms, the main question this study is trying to address is why science-in-TV in Europe appears as it does. We seek to link research focussing on the detailed analysis of science representations on television (Silverstone, 1984; Collins, 1987; Hornig, 1990; Leon, 2008), and media research focussing on the historical genesis and current political regulation of national media systems (see for instance Hallin and Mancini, 2004; Napoli, 2004; Open Society Institute, 2005, 2008). The former studies provide deeper insights into the selection and reconstruction of scientific subject matters, which reflect and – at the same time – reinforce popular images of science. But their studies do not give much attention to production constraints or other relevant factors which could provide an insight into why media treat science as they do. The latter scholars inter alia shed light on distinct media policies in Europe which significantly influence national channel patterns. However, they do not refer to clearly defined content categories but to fairly rough distinctions such as information versus entertainment or fictional versus factual. Accordingly, we know more about historical roots and current practices of media regulation across Europe than we do about the effects of these different regimes on the provision of specific content in European societies.

2. Theoretical framework

Science-in-the-media studies usually conceptualise journalism as a mere mediator between science and lay audiences. Based on what science is published they normally reflect critically on the picture of science drawn by journalism (e.g. Pellechia, 1997; Kua et al., 2004; Major and Atwood, 2004). Commonly a mismatch is observed between science-in-the-media and science which ought to become public. This frequently gives rise to criticism of journalism in general and its selectivity in particular. In his theoretical design of science journalism, Kohring (2005) holds the view that this model shaped, over time, almost all of English and German literature on the subject.

According to Kohring, the main problem of these analyses lies in their concept of journalism as a mediator. In fact, its societal function does not consist of mediating between science and lay audiences. In a theoretical design which rests significantly on Luhmann's functional theory (Luhmann, 1995), Kohring conceptualises journalism as a powerful subsystem of the public. This in turn is seen as a social system

with a distinctive function, which enables other systems like politics or economics to integrate expectations about their environment in their operations. Consequently, journalism is not a passive mediator but an active societal actor following its own logic.

Based on this, Kohring advocates entirely different empirical approaches. Studies that are guided by an elaborated understanding of what science is, can indeed provide descriptions of journalistic selectivity. But they are ill-suited *to explain* journalistic selectivity. Accordingly, this theoretical model suggests that science-in-the-media studies aiming to explain journalistic selectivity should shift their perspective. Instead of choosing science as their point of origin, studies should be guided by distinctions relevant to journalism's identity. In doing this, science-in-the-media studies would immerse themselves in problems journalism faces with science rather than repeat over and over problems science faces with journalism.

Theorists have ascertained that the necessity to gain attention for its products is vital for the identity of journalism. Journalism cannot be journalism without audiences. Attention given to statements depends largely on their informational value. A statement is only informative if it is "new," i.e. if it was previously unknown to recipients, and if it is relevant to the recipient (Merten, 1973; Luhmann, 1981; Ott, 2004).

Informational value depends on the context and is in the eye of the beholder. What is new and relevant for one individual, might be already known and irrelevant to another. Hence, there are endless messages which could potentially gain attention.

In order to produce messages that can gain attention, editorial units like science programme departments must follow routines in their selectivity. Studies influenced by systems theory have used the term "decision-making programmes" (Rühl, 2002) to describe journalism's reconstruction of the world through the reduction of hyper-complexity. These routines serve to protect the bond between journalism and its audiences (Rühl, 2002: 318). Lublinski (2004, 2008, 2011), who studied three German radio science programmes and a news agency extensively through participant observation, called these decision-making programmes "editorial concepts."

From this perspective, a television science programme for example can be neither a reflection nor a distortion of what is going on "out there" but is, rather, a reflection of the practices of workers guided by established editorial concepts (Fishman, 1982: 220). That means that a journalist who is a member of an organisational unit such as a science programme team, cannot act professionally in any way he or she sees fit; editorial concepts confine significantly what actually *can be* reported.

The decision for or against a particular editorial concept can have far-reaching consequences. When a television channel decides not to include a science news programme in its schedule, it does not need to accumulate expertise in observing and processing scientific events as news. The "typification" of news (Tuchman, 1973: 116ff.) by media professionals working for such a channel would transform a science event into a non-event (Fishman, 1982). If a country lacks science news or information programmes on television, there is a reduced chance of science news of any kind becoming public via television, however intensively public relations professionals within scientific institutions may work on it. More importantly, science news will not be selected and processed by media professionals who are *specialised* in handling new scientific findings. In such a case the channel simply lacks the organisational structures for monitoring and reconstructing what is going on in the science system.

We can distinguish several editorial concepts guiding journalism in its relations with audiences. These distinctions are influenced by German studies that focus on key decisions within science specialist units which shaped science's reconstruction by media professionals working for these programmes. These decisions affect the topic fields that are continuously monitored, the precise ways in which the news value of timeliness is applied and the "special processes of how to select and reconstruct an issue" (Lublinski, 2004: 95f.; 2008: 281; 2011). These latter refer to what we will call the input and output orientation of programmes. We have operationalised these insights by distinguishing programme characteristics which can be reliably observed by researchers even without access to production processes within science programmes. These characteristics are:

A) The time between a topic becoming publicly known and its actual appearance in the media. The preparation time of a media product can be short and counted in hours or it can be long, as much as one year. The shorter the preparation time, the more likely it is that the topic is informative, i.e. unknown to recipients. Accordingly, we distinguish programmes whose contents are characterised by short preparation times from those with comparatively long preparation times.

B) The second category is more complex. It refers to how journalism actually gets the topics. We distinguished between two types of programmes: *input oriented programmes*, which mainly observe and process events from certain societal subsystems – in this context predominantly from science – and

output oriented programmes, which do not primarily focus on happenings of a respective environment, but strive to fulfil certain functions like education or advice or to achieve certain effects like entertainment (Meier, 2002: 23).

C) The third category refers to the topic field being continuously monitored. In this category we distinguished programmes which focus on just one theme, for instance health or environment issues, from those which take a multi-thematic approach.

The first empirical question this study addresses is: What editorial concepts shape science television programmes in Europe? The second question is more demanding and leads to the core of this study: What factors influence the choice of editorial concepts by television professionals?

In relation to the second research question, we refer to models that show how journalism's selectivity is based less on individual biases of reporters and editors than on various social factors that can be classified analytically at different levels. These levels have been named differently (e.g. Dimmick and Coit, 1982; Weischenberg, 1992; Shoemaker and Reese, 1996) but all classifications attempt to organise hierarchically the complex influences on media selectivity. Specifically, decisions made on higher levels impose constraints which narrow the choices on lower levels. These models provide media studies with heuristic frameworks to reduce complexity and organise empirical data and relevant literature (Löffelholz, 2009).

In our own search for relevant literature on media selection of science we looked for studies that integrated more than one analytical level into their design. We considered that more restricted studies would not provide valid insights on correlations between journalism's selection of science content and structural features at micro (individual), meso (medium, channel, newsroom) or macro (society, culture) levels. Applying these criteria, we found six relevant studies on science in the press. Three incorporate the content level and an organisational, i.e. meso level (Bader, 1990; Pellechia, 1997; Hijmans et al., 2003), another incorporates the content level and the medium level (Hinkle and Elliott, 1989) and two others incorporate country context in their design (Bauer et al., 2006; Bucchi and Mazzolini, 2003).

We found eight studies on science in television (Evans et al., 1990; Hansen and Dickinson, 1992; Evans, 1993; Willems and Hanssen, 1993; Göpfert, 1996; Scholz and Göpfert, 1998; León, 2006, 2008; Maeseele and Desmet, 2008) and one on radio (LaFollette, 2002); only two refer to factors that might influence the selectivity of television programmes.

Maeseele and Desmet (2008) analyse science reporting on public channels in Belgium. They note a decrease in the total amount of science between 1997 and 1999 and an increase from 2000 onwards which they link to increased government efforts at promoting the popularisation of science, technology and technological innovation. This is the only report we are aware of where the influence of a single political initiative on science media content has been analysed.

Göpfert (1996) found a positive correlation between the characteristics of television markets and the volume of science programming in television. He compared the scheduling of science programmes in the UK and Germany. He reported a significantly smaller number of science programmes but a larger audience for these programmes in the UK than in Germany. In Germany, the majority of science programmes were broadcast mainly on small public channels with very small market shares. The lower number of science programmes in the UK, with its fewer channels, reached in absolute figures a larger audience through being broadcast in peak time. In a follow-up study, Scholz and Göpfert (1998) reported an increase in science programmes in 1997 in Germany compared to 1992. This increase was due to the specialised small public channels, which extended their reporting of science content.

The available literature offers little insight into the influences on media selection of science. But Göpfert (1996) does offer guidance in his reference to television market structure. Channels are the building blocks of media systems (Webster, 2009) and our research seeks to explore how media systems and channel characteristics affect the volume and the selection of science programmes on television.

3. Methods

A main characteristic of good research practice in international settings is not to assume equivalency, but to establish it (Rippl and Seipel, 2008: 63). This has been tried in this study by a carefully conceptualised definition of science programmes, which can be linked to established concepts in journalism research. Besides the careful use of pretest, regular discussions about the meaning of the concepts in question have been conducted within this research team, which consisted of 10 researchers from six countries.

In this study a science programme was defined as one that

a) specialised in the coverage of research findings or events related to the natural and social sciences, humanities or applied sciences such as engineering and medicine (Bauer et al., 2006; Bucchi and Mazzolini, 2003) and/or

b) specialised in fulfilling specified needs of its audience by linking scientific expertise or scientific findings related to the natural and social sciences, humanities or applied sciences such as engineering and medicine with societal, political, economic or everyday topics (Hijmans et al., 2003).

A programme was considered "specialised" if it mainly or exclusively covered science content in one of the mentioned ways.[ii]

This definition was operationalised by developing a battery of keywords referring to content areas, where science as topic or as service can be expected with a certain probability. These keywords needed to be mentioned in the title, the subtitle or the self-description of the programme. Wildlife programmes have been excluded since these programmes use scientific research mainly implicitly. Science documentaries broadcast in general documentary slots have been included.

Our study searched for science programmes on all television channels in 11 European countries in five reference weeks between spring 2007 and summer 2008 that together reached a market share of at least 85 per cent in each country.[iii] We identified different editorial concepts as shaping science programmes through self-descriptions of the programmes on their websites or in programme guides. The resulting classification into programme types was validated by a content analysis of a sample of 145 television programmes (33 per cent of the total sample) that were broadcast in eight[iv] of the 11 countries. Two episodes of each sampled programme were analysed in detail and this approach resulted in the analysis of 730 individual items within these programmes.

A sample of science programmes broadcast in the USA and Australia was used to run pretests. The semantic variables (science as topic or service; topic field; relatedness to news) did not reach sufficient reliability on the first run (Holsti coefficient .78). After discussing the meaning of the items extensively and rerunning the pretest, a sufficient reliability of .83 was reached. The formal (lengths; scheduling; channel characteristics etc.) variables reached sufficient reliability on the first run (Holsti coefficient .93–.97).[v]

In order to enable a comparative analysis of various programmes which differ in length and frequency of scheduling, we have constructed the unit "minutes/hours broadcast in an average week." Accordingly, a programme of 60 minutes length which was broadcast 26 times a year accounted for 30 minutes' airtime in an average week. A daily programme of 30 minutes length amounted to 210 minutes' airtime in an average week.

4. Findings 1: Volume of science on television across countries

Our sample comprised 439 television programmes which filled 195 hours' airtime in an average week and could be categorised as specialised in science. It represents the total of specialised science programming in 11 European countries on channels which together reached a market share of 85 per cent. We found fairly big differences between countries in the sample (Figure 1). Of the combined airtime for science programmes 40 per cent was found in television channels in Germany while French, Spanish, British, Swedish and Finnish channels broadcast 5–12 per cent each of the total. The other countries, Austria, Greece, Bulgaria, Ireland and Estonia, broadcast less than 5 per cent each.

Differences between countries in the total airtime for science programmes mainly reflected differences in the number of television channels which reached a combined market share of 85 per cent. Television watching in Britain, the least fragmented market, was still concentrated on only five free-to-air channels (BBC 1, BBC 2, ITV, Channel 4 and Channel Five), but in Germany, the most fragmented market, the 85 per cent market share was spread across 18 different channels, of which 12 reached less than 5 per cent market share. Relating this to the distribution of total airtime for science programmes, this appears to indicate that fragmentation of television markets affects the volume of science positively. We will elaborate on this thesis further in the following sections by analysing the volume of science programming provided by commercial and public service channels.

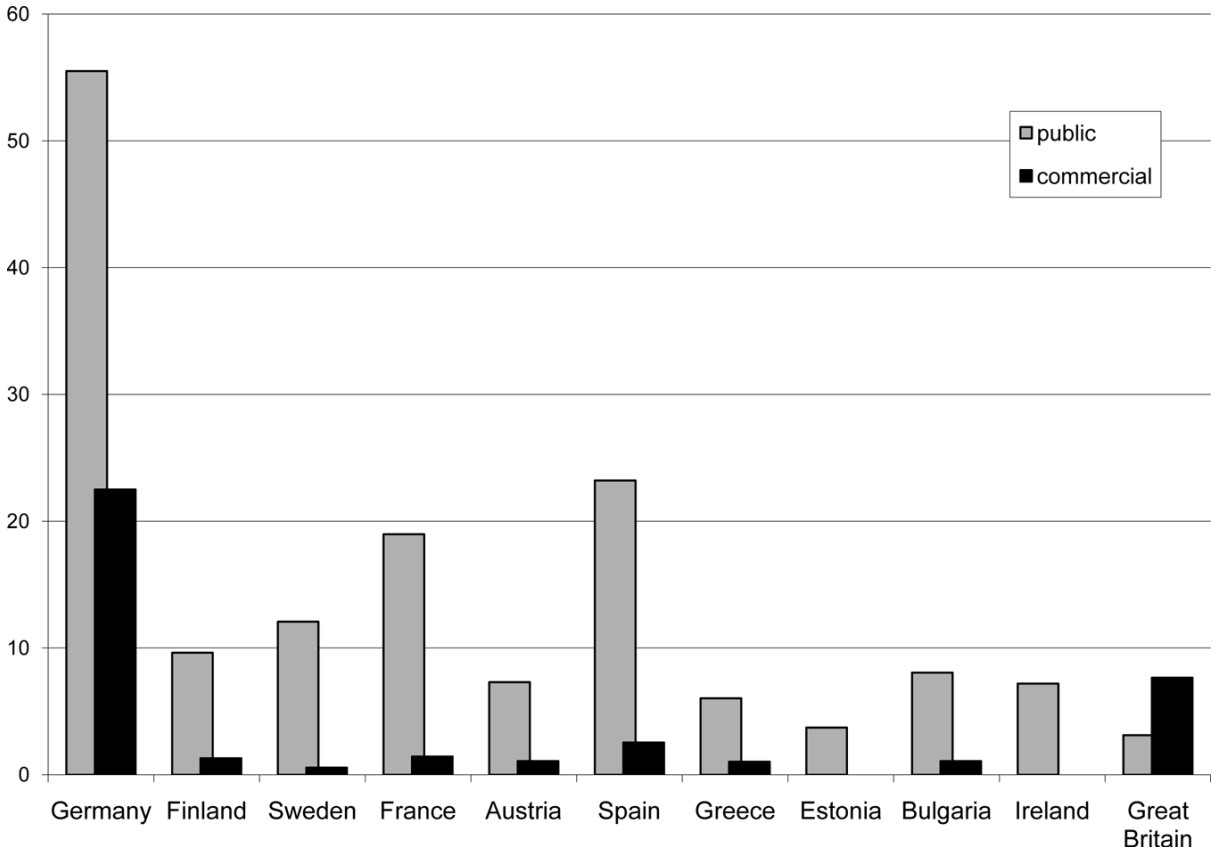

Figure 1. Distribution of programme hours across countries broadcast in an average week 2007/2008 (N = 195 hours) by public and commercial channels.

Science on commercial channels

Generally, *commercial channels* did not contribute substantially to the provision of science programmes in Europe, accounting for 20 per cent of all science programming in our sample of countries. The number of commercial channels in a given country had little effect on the level of science programming. But it is not the case that commercial channels broadcast no science programmes.

The big exception to the general rule, Great Britain, sheds light on the fact that the relation between commercial television broadcasters and science programming is a bit more complex. In Great Britain, the majority of science programming (70 per cent of 10:22 minutes in an average week) is done by commercial broadcasters, namely Channel 4 and Channel Five. As far as Channel 4 is concerned, the actual classification as commercial is problematic, since it is perhaps better described as a "commercially funded public broadcaster" (Ward, 2005: 1606), a publicly owned channel which is unique in our sample of channels. The Communications Act 2003 obliges this channel to provide "high quality and diverse programming," which includes "programs of an educational nature and other programs of educative value" (Ward, 2005: 1632).

While its special legal status might explain the contribution of Channel 4, it does not provide an explanation, however, as to why Channel Five, which does not enjoy an equivalent special regime, contributed 46 per cent to the provision of science programmes in Great Britain. A particular regime, therefore, cannot be the only factor that explains why Channel 4 and Channel Five do so much science programming.

Both of these channels have significantly smaller market shares than the main commercial network ITV (18 per cent market share), which does very little science reporting. In Britain, science reporting was concentrated on three mid-sized channels (BBC 2, Channel 4 and Channel Five) with market shares of 5–9 per cent in 2008. This indicates that the contribution of commercial channels to science programming is not only due to regulation, but also mediated by their market position.

A similar pattern appears in the German market, which is the only other one where commercial broadcasters contributed significantly to science programming. Here too this was concentrated on mid-sized commercial channels (SAT 1, Pro 7, Vox), whose market shares are much lower than those of the main broadcasters, especially the big commercial channel RTL (13 per cent market share), which broadcast no science programmes.

Overall, we found that science programmes on commercial channels tended to be broadcast on mid-sized channels. Almost two thirds of total airtime for science programmes on commercial channels was broadcast by mid-sized commercial channels (Table 1).

Table 1. Distribution of airtime through the total number of commercial channels in 11 European countries (*N* = 39:20 hours)

Market share in per cent	Total number of channels	Number of programmes	Total airtime in hh:min	Airtime in %
1–5	18	8	9:41	24
5–10	15	39	24:14	62
>10	19	14	5:25	14
Total	**52**	**61**	**39:20**	**100**

This leads to the conclusion that both specific regulations and a specific segmentation of television markets influence the volume of science programming provided by commercial channels.

Science on public service channels

Apart from the case of Great Britain the differences between countries in airtime given to science programmes reflected mostly differences in the number of public service channels in a given country. Overall, we can state that the fragmentation of public service channels generally coincides with the airtime given to science programmes and the pattern is remarkably consistent across Europe.

Specifically, if one correlates the airtime devoted to science in each country with the number of public channels in each country then Spearman's rho correlation is 0.81 ($p < 0.001$).

In order to explain the differences in airtime we need also to consider the specific segmentation of public service television markets. A decisive factor is the clear segmentation into, on the one hand, one or two big public broadcasters, which reach at least 10 per cent market share, and, on the other hand, one or more small channels, which reach less than 5 per cent market share.

All countries except Greece and Austria with such segmentation (Germany, Finland, Sweden, France, Spain) dedicated in total more airtime to science programmes than the other countries. With the exception of Spain they all showed a similar pattern in the distribution of airtime across channels (Figure 2). The small channels accounted for the lion's share of airtime, whereas the airtime on big public channels generally did not exceed a limit of two and a half hours science programming per week and per channel.

The structure would be even more regular if phone-in health advice programmes were excluded. This applies to Bulgaria, France and Spain. In Spain, a phone-in health advice programme (*Saber vivir*), scheduled daily in the morning, was the only science programme on the major public channel TVE La Primera. The average weekly airtime on the small public channels in France would be two and a half hours shorter were it not for two lengthy daily health programmes on France 5 (*Hello Doctor*; *Le Magazine de la Santé*). Finally, in Bulgaria, more than four and a half hours airtime on BNT One is allotted to a single daily health programme.

Compared with the other segmented markets, Spain and Greece have considerably lower average airtime for science programmes on small public channels and such programmes are far more often scheduled outside prime time.[vi] While public channels in Germany, Austria, Sweden, Finland and France broadcast 35 per cent of science programmes in peak hours (7–11 pm), their counterparts in Spain and Greece scheduled only 15 per cent in peak time (Figure 3).

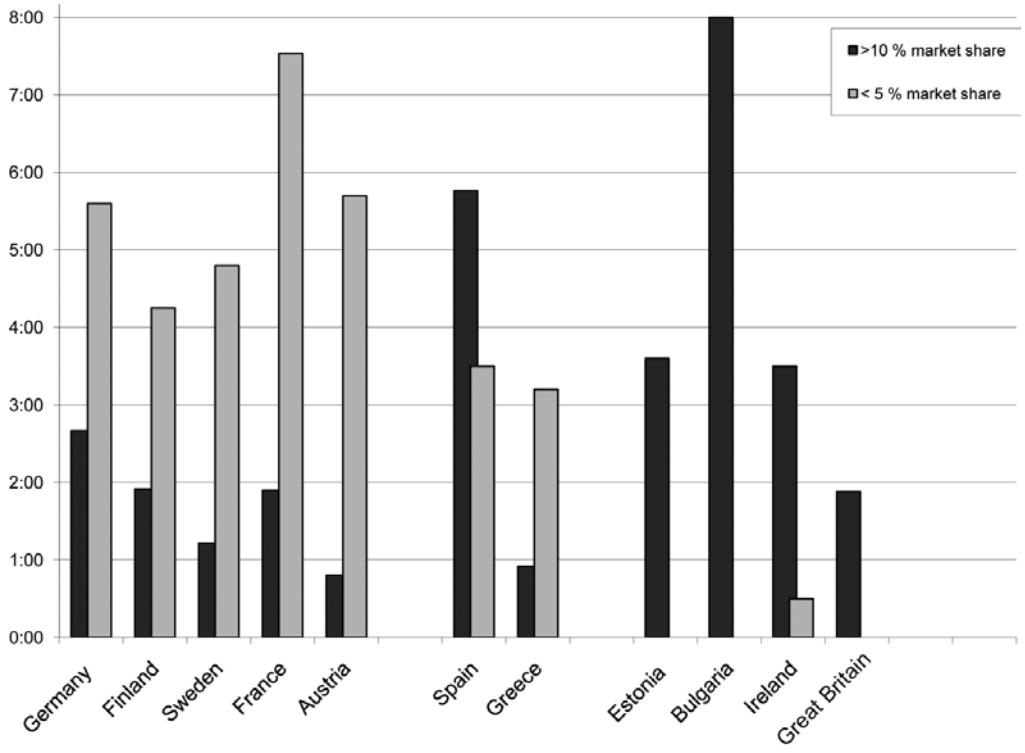

Figure 2. Average airtime for television science programmes per public channel in hours per week 2007/2008.

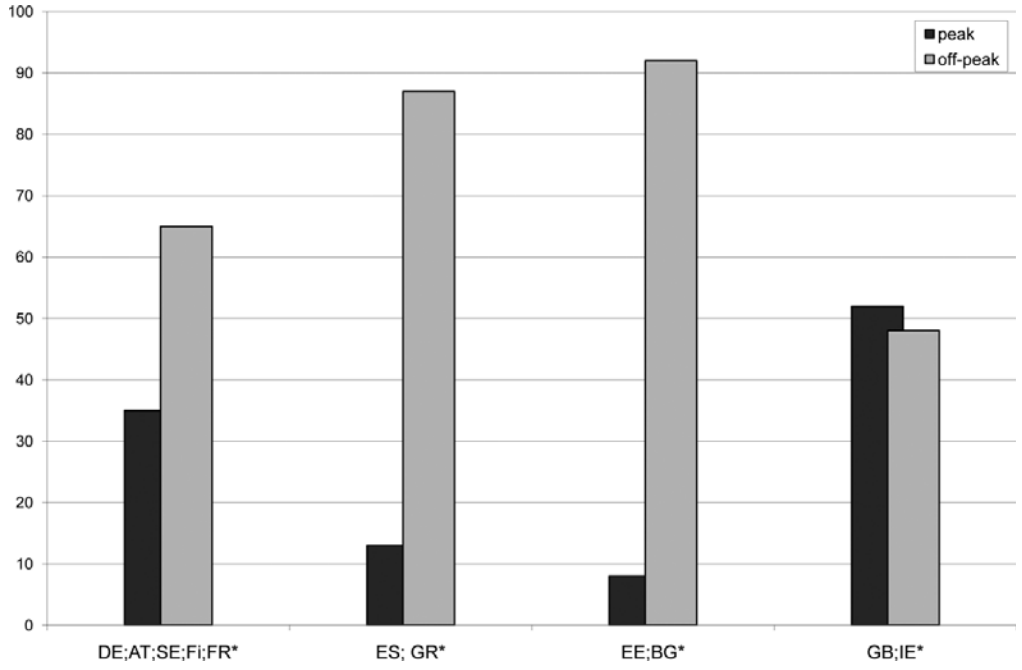

Figure 3. Share of airtime (in per cent) at off-peak times and in peak hours. *DE = Germany; AT = Austria; SE = Sweden; FI = Finland; FR = France. *ES = Spain; GR = Greece. *EE = Estonia; BG = Bulgaria. *GB = Great Britain; IE = Ireland.

This pattern coincides with their particular market position, which differs from that of small public channels in the other segmented markets. Greece and Spain do not have thematically specialised channels devoted more or less explicitly to education and/or culture (examples elsewhere are: 3sat; Teema; Kunskapskanalen; ARTE/France 5). Greek and Spanish public channels, although small, are all general-interest channels and compete intensively with each other and with commercial broadcasters. We believe that this is why the volume of science programming on small channels in Greece and Spain is limited and predominantly scheduled at off-peak hours.

This draws attention to two factors, which are in most cases reciprocally linked and which may be significant when trying to explain the pattern in the volume and scheduling of science programming across countries, namely the dependence of public channels on advertising and their total public income. All public channels in Greece and Spain depend heavily on advertising revenues and get a relatively small share of their income from licence fees or other public means (European Audiovisual Observatory, 2009). Spanish television was always mainly supported by advertising and, from 1982 to 1992, exclusively so. There was never a licence fee. Since 1993 the deficits of public service broadcasters have meant that public funds have been provided by the state and the Autonomous Communities (Hallin and Mancini, 2004: 126; de Mateo, 2004: 229). Taking into account their small market shares which limit the amount of income from advertising, it seems likely that Greek and Spanish public channels unlike their relatives in the other segmented markets lack the funds to produce science programmes with mass appeal at peak time.

Big public broadcasters that dedicated more than three hours weekly to science, namely those in Estonia, Ireland and Bulgaria, were not in segmented markets. As mentioned earlier, Bulgaria's higher airtime is due to a single daily health programme.

Great Britain does not fully fit into this analytical framework and is difficult to classify by segmentation of television markets. There is much segmentation below the one per cent audience share criterion which was used as a threshold for including a channel in our sample and Great Britain was the only country apart from Ireland and Austria, where the sample of channels did not reach an accumulated market share of 85 per cent. The market shows strong characteristics of non-segmented countries, since a fairly high audience share of 60 per cent is spread over just five free-to-air channels (European Audiovisual Observatory, 2009: 127; Ward, 2005). This is why we treat Great Britain as a non-segmented market.

The relatively small amount of airtime for science programmes on its big and mid-sized public channels becomes understandable when we take into account that all channels in Great Britain still concentrate science programming in peak hours between 7 pm and 11 pm as they did in 1992 (Göpfert, 1996). Ireland is the only other country where science programmes get a high share of airtime (about 50 per cent) in peak hours.

In trying to group non-segmented markets, we need to distinguish Estonia and Bulgaria from the others owing to their distinctive scheduling policies; these look more like those of Spanish and Greek channels which operate in different market contexts. Bulgaria concentrated science programmes in the morning and in the afternoon and broadcast no science programmes during prime time at all. Estonia also showed a concentration of these programmes in the afternoon.

5. Findings 2: Structure of science programming across Europe

After having explored differences in the volume of science programming across Europe we will next explore differences in structure by distinguishing editorial concepts. We identified five different programme types. These programme types represent different ways for programmes to relate with their audiences:

A) Information programmes are science news broadcasts which are characterised by short preparation time and specialisation in monitoring current events within the science system. Examples are the German programmes *nano*, *Odysso* or *neues* and the Swedish programme *Vetenskapsmagasin*. This concept accounted for 8 per cent of the total 195 hours science programming in an average week in 2007 and 2008.

B) Popularisation programmes (predominantly documentaries) typically present science in a factual and informative manner, often consisting of interviews accompanied by narration. They are characterised by long preparation time and primary orientation to the information to be derived from

science ("primary input orientation"). Examples are *Newton* (Austria), *Terra X* (Germany), *Horizon* or *Time Team* (UK). This concept accounted for 46 per cent of the total 195 hours airtime.

C) Edutainment programmes are guided by the aim to educate and entertain the audiences with reference to scientific ideas and processes. However, scientific explanations are typically only a minor part of the programme and personalities such as performers or sports stars often dominate. Examples are *Kopfball* (Germany), *Forscherexpress* (Austria), *Rough Science* (UK and imported by Finland) and *C'est pas sorcier* (France). This concept accounted for 19 per cent of the total airtime.

D) Advice programmes have short preparation times and give advice on, for example, healthier living or how to save energy. They tend to involve lay people centrally. Selection of topics is not input oriented, but guided by the necessity to provide the audience with practical tips. Examples include programmes such as *Doctor, Health*, *Saber vivir* (Spain) or *Sanatate pentru toti!* (Bulgaria). This concept accounted for 23 per cent of the total 195 hours science programming.

E) Advocacy programmes focus on events and issues with a scientific dimension but in social systems other than science, especially politics. Environmental protection is a common topic in this programme type. These programmes are characterised by short preparation times. Examples are *Osoon* (Estonia), *Mera natur* (Sweden), *Umwelt* (Germany) or *El medi ambient* (Spain). This concept finally accounted for 5 per cent airtime in an average week in 2007 and 2008.

Accordingly, television in Europe is generally characterised by relatively few specialised programmes that would qualify as information journalism, i.e. those that at least to some extent pick up recent events in science and process them into news-shaped journalistic products. The chances for new scientific findings to be picked up by a television science journalist and broadcast are slim. The exception is science news related to the treatment of diseases. Such news items can be found in health magazines which are not specialised in developments in current medical research but are interested in the applied medical sector. It is mainly in this sector that events can be found that can be turned into a more or less reliable, topical health tips for the audience.

To understand what this means, one has to be aware that journalism is the organised production of statements that are made available to the public. It requires a specialised editorial unit to provide relevant news from the realm of science *regularly*, one that does nothing else other than collecting and distributing relevant news events from the sciences. Because a specialised editorial office or unit does this on a regular basis, they accumulate expertise; they develop efficient routines to find relevant news items; they develop assessment standards that serve to distinguish relevant from irrelevant news items; they accumulate knowledge about research progress in the particular fields of science they observe. This does not mean that science news would never be on television if these specialised programmes did not exist. It rather means that only a few specialised units exist, that are *specialised* in the handling of science news items in the aforementioned way.

The majority (65%) of programmes in the sample were of a type requiring long preparation time. Accordingly, television science related with its audiences predominantly through reconstruction of science as a fascinating journey to the frontiers of knowledge – a typical feature of popularisation programmes – or by using scientific explanation of things that are, in a broad sense, part of people's normal realm of experience (edutainment).

We will next explore the distribution of airtime for the different programme types across countries. As well as volume, segmentation of television markets and dependency of public service channels on commercial income also influence the structure of science programming. As Figure 4 indicates, we can distinguish three groups of countries:

A) The Northern Countries including Germany and Austria in part.

B) The South-Eastern Countries plus Estonia.

C) Great Britain and Ireland.

These three groups of countries show some particularities in the choice of programme types which structure science programming in a specific way.

The *Northern Countries including Germany and Austria* with segmented public television markets and comparably low market pressures were the only ones that dedicated a share worth mentioning to information programmes. The provision of information programmes was mainly restricted to segmented public television markets, which include thematically specialised channels. In all other markets the specialisation in providing news-related information on science was totally or largely absent.

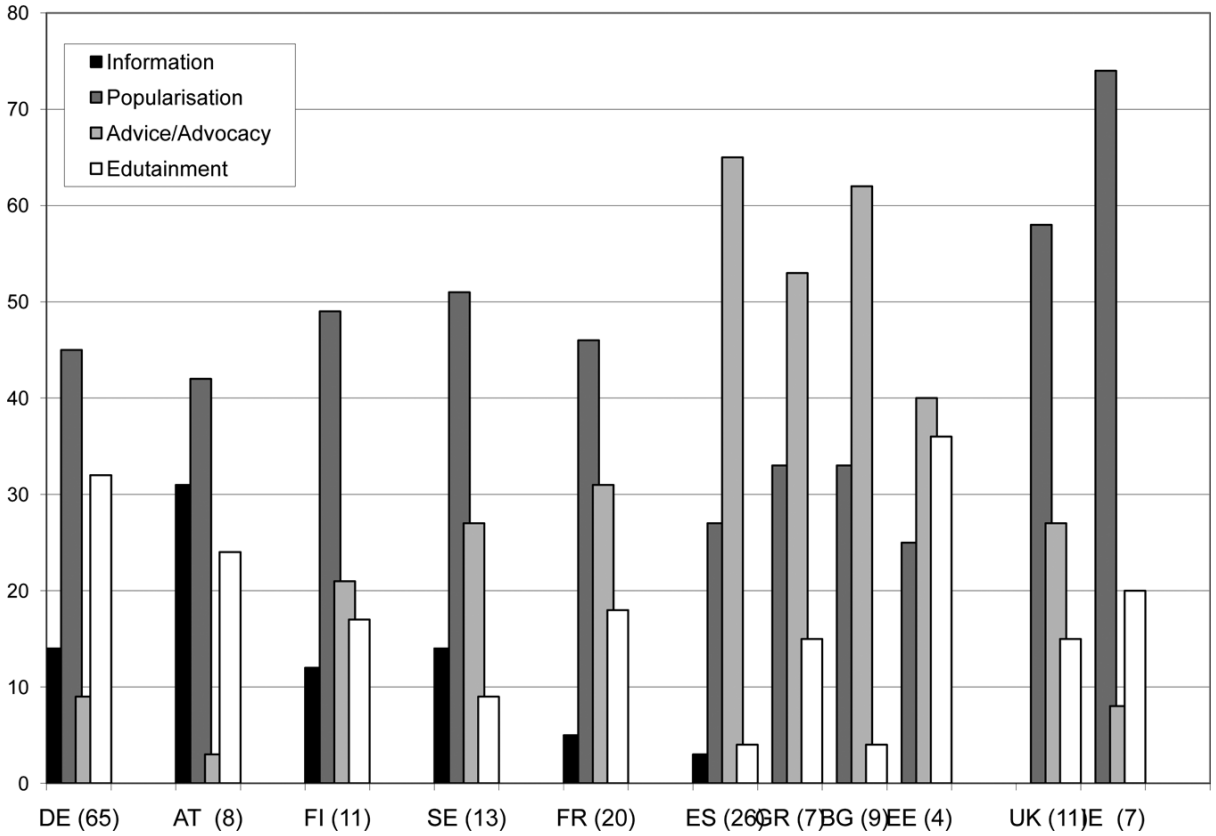

Figure 4. Share of airtime dedicated to different programme types in television in per cent (total airtime per country in parentheses). DE = Germany; AT = Austria; FI = Finland; SE = Sweden; FR = France; ES = Spain; GR = Greece; BG = Bulgaria; EE = Estonia; UK = United Kingdom; IE = Ireland

The vast majority (80 per cent) of the television airtime dedicated to information programmes was represented by public channels with less than 3 per cent market share and 81 per cent of this airtime was scheduled at off-peak hours. The only country with an information programme on television on a bigger channel between 7 pm and 11 pm was Sweden. This suggests that the existence of thematically specialised public channels within a media system is key to the presence of a specialism in science news on television. This does not mean that science news is never seen on television if these specialised programmes do not exist. In fact, science items can be regularly found in television news (Leon, 2006, 2008). But it does mean that there are few specialist science news units in European television channels.

Television in segmented markets with high market pressures and television in non-segmented markets is organisationally less well equipped for handling new scientific findings as news. The lack of specialist editorial units outside Germany, Finland and Sweden appears to indicate that the specialised treatment of science news constitutes a threshold of specialisation that television can only cross in segmented public television markets with low market pressures.

Within this group of countries, *Germany* showed some particularities in the choice of programme types, with its broadcasters giving a fairly high share of airtime to edutainment and a low share to advice and advocacy programmes. This reflected the preferences of the mid-sized commercial broadcasters. In contrast to British commercial channels (see below), edutainment is the first choice of commercial channels in Germany.

Despite being a segmented market, *France* is difficult to classify. The science programmes on French channels are fairly diversified, as they are in Germany, Sweden and Finland. But there is a notable lack of popularisation programmes on the big public channels France 2 and France 3, which are much more

heavily exposed to market pressures than their counterparts in the Nordic countries and Germany. The airtime given to popularisation programmes was shorter than in France only in Spain and Greece and the airtime given to edutainment was longer only in Germany. France's big public channels, like those from South-Eastern Europe and Estonia, concentrated science programmes at off-peak hours leaving only about 10 per cent in prime time. This was the smallest prime-time share of all countries with segmented markets. This is why we must place France somewhere in between Northern Countries and South-Eastern Countries.

The structure of science programming in *Spain*, *Greece*, *Bulgaria* and *Estonia* was characterised by the dominance of output oriented programmes with low preparation times, namely advice programmes and advocacy programmes, the almost complete lack of information programmes and the weakness of popularisation programmes. There were several similarities between these countries which correlate with this pattern. Firstly this pattern coincides with the weakness of public service broadcasters. With the exception of Estonia, the public television markets in these countries are heavily exposed to sectors pressures. Public service broadcasting is also weak in terms of segmentation and in terms of public income. In Spain and Greece for instance (as in Portugal and particularly Italy), "public service broadcasting in the full sense of the word never really existed" (Hallin and Mancini, 2004: 125). Instead, both countries have been characterised by a "savage deregulation" (Traquina, 1995). Bulgaria also showed at least some characteristics of a "savage deregulation" of television markets (Kavrakova, 2005). We believe that this helps us to understand the dominance of fairly cheap advice and advocacy programmes in these countries and the small number of more expensive popularisation programmes.

In *Ireland* and *Great Britain* science programming on television was characterised by a large number of popularisation programmes and the total lack of information programmes. In Ireland, popularisation programmes were especially dominant.

The high share of popularisation programmes especially in Great Britain was remarkable, since popularisation was dominated by commercial channels or commercially funded public channels. Generally, large-scale popular reconstruction of big scientific issues is not part of what can be expected from commercial channels. Outside Great Britain, there is an almost total lack of these programmes on commercial television channels in Europe. This raises the question of why popularisation programmes dominate in these countries.

Popularisation programmes are expensive, specifically if they need to target a large audience in peak hours as is the case in Great Britain and in Ireland. They require a very high production quality, otherwise they would fail to reach mass appeal.

The first thing to note is that Great Britain has a long tradition of producing costly popularisation programmes, which dates back to the 1960s, when the famous programme *Horizon* was first broadcast (although it started off as a magazine programme, later becoming a science documentary series). This later became a model of costly science popularisation throughout Europe and further afield (Silverstone, 1984). The early success of this programme may have established a tradition that continues until today.

A second factor is that timeless, high quality science reconstruction is easier to trade across national borders than any other science programme type. Half of the airtime for popularisation in our sample was given to imported or co-produced programmes, almost twice as much as edutainment programmes which came next. British commercial broadcasters not only have to look for advertising income at home but can also count on trading income. In 2007 and 2008 Channel 4 earned €47 million from programme sales or 4 per cent of its total commercial income.

All this does not provide an explanation of why Ireland, a very small media market, resembles Great Britain regarding the dominance of popularisation programmes and regarding scheduling policies. One strong reason for channels in Ireland dedicating such a big share of airtime to popularisation programmes may be that its channels can easily use the offerings of English-language international programme traders which require no further treatments such as subtitling or dubbing. RTE 1 and RTE 2 depended heavily on programme imports, primarily from the US market, with almost the whole airtime (93%) given to popularisation programmes accounted for by imports.

6. Conclusions

In this article we have sought to bring the diverse European landscape of science on television into a certain order by relating relevant factors mainly on a meso level with the volume and structure of science television programmes across Europe. We proposed three factors as relevant to understanding science on television:

A) The segmentation/fragmentation of public television markets.
B) The existence of mid-sized commercial channels which as part of their niche marketing tend to present more science programmes.
C) The weight of market forces on public service channels.

We believe that each of these factors works properly in quantitative terms, that is, we can speak about a high or low level of segmentation or a high or low degree of market pressure. But it is decisive to add, and our investigation has shown this, that each factor is fairly complex and needs further qualitative distinctions. In addition, depending upon the country, some additional factors are required to make sense of the distribution of science across television channels and across programme types.

However, by applying these market-structure factors, we identified countries whose channel patterns enhance the probability that a varied picture of science is presented on television – these are Sweden, Finland, Germany and Austria in part. These countries are characterised by relatively highly segmented markets and low market pressures on public service broadcasting. They must be distinguished from those which present a less varied picture of science and broadcast a lower volume of science content on television – these are Great Britain and Ireland.

We finally identified countries whose media systems decrease considerably the probability of a varied picture of science being presented on television – these are Spain, Greece, Bulgaria and Estonia. Public channels in Greece and Spain in particular are heavily exposed to market forces, which evidently restrict the volume of science programmes broadcast and their scheduling at times of large audiences.

France cannot be classified convincingly in any of the mentioned groups; its characteristics place that country somewhere between the Northern Countries including Germany and South-Eastern Europe.

This study has shown that media system variables really matter to the volume, but also the structure of the provision of science contents via television. It has started to close a gap between the detailed analysis of science representations provided by television and media research focussing on current political regulation of national media systems. Further research is certainly needed to explain in greater detail why science is covered by mass media as it is. We know little in particular about the differences in the tradition of science reporting in visual media across countries. The strength or weakness of a tradition in science reporting on television is often more a plausible assumption than a fact which has been proven historically. It is up to future research to identify additional factors apart from media economics that may enhance our understanding of why science is treated by television as it is.

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References

Bader R (1990) How science news sections influence newspaper science coverage: A case study. *Journalism Quarterly* 67: 88–96.

Bauer MW, Petkova K, Boyadjieva P and Gornev G (2006) Long-term trends in the public representation of science across the "Iron Curtain": 1946–1995. *Social Science Studies* 36(1): 99–131.

Bucchi M and Mazzolini RG (2003) Big science, little news: Science coverage in the Italian daily press, 1946–1997. *Public Understanding of Science* 12: 7–24.

Collins HM (1987) Certainty and the public understanding of science: Science on television. *Social Studies of Science* 17: 689–713.

De Mateo R (2004) Spain. In: Kelly M, Mazzoleni G, and McQuail D (eds) *The Media in Europe*. London: SAGE, pp. 225–236.

Dimmick J and Coit P (1982) Levels of analysis in mass media decision making: A taxonomy, research strategy, and illustrative data analysis. *Communication Research* 9(1): 3–32.

European Audiovisual Observatory (2009) *Television in 36 European States: Yearbook 2009*, Volume 1. Strasbourg: European Audiovisual Observatory.
Evans W (1993) The mundane and the arcane: Media coverage of social and natural science. Paper presented to the annual meeting of the Association for Education in Journalism and Mass Communication, Kansas City, 13 August.
Evans WA, Krippendorf M, Yoon JH, Posluszny P and Thomas S (1990) Science in the prestige and national tabloid presses. *Social Science Quarterly* 71(1): 105–117.
Fishman M (1982) News and nonevents: Making the visible invisible. In: Ettema J and Whitney DC (eds) *Individuals in Mass Media Organizations: Creativity and Constraint*. Beverly Hills, CA: SAGE, pp. 219–240.
Göpfert W (1996) Scheduled science: TV coverage of science, technology, medicine and social science and programming policies in Britain and Germany. *Public Understanding of Science* 5: 361–374.
Gregory J and Miller S (1998) Science in Public: Communication, Culture and Credibility. New York: Plenum.
Hallin DC and Mancini P (2004) *Comparing Media Systems: Three Models of Media and Politics*. Cambridge: Cambridge University Press.
Hansen A and Dickinson R (1992) Science coverage in the British mass media: Media output and source input. *Communications* 17: 365–377.
Hijmans E, Pleijter A and Wester F (2003) Covering scientific research in Dutch newspapers. *Science Communication* 25(2): 153–176.
Hinkle G and Elliott W (1989) Science coverage in three newspapers and three supermarket tabloids. *Journalism Quarterly* 66: 353–358.
Hornig S (1990) Television's NOVA and the construction of scientific truth. *Critical Studies in Mass Communication* 7: 11–23.
Kavrakova A (2005) Bulgaria. In: Open Society Institute (ed.) *Television across Europe: Regulation, Policy and Independence*, Volume 3. Budapest: Open Society Institute, pp. 340–423.
Kohring M (2005) *Wissenschaftsjournalismus: Forschungsüberblick und Theorieentwurf*. Konstanz: uvk.
Kua E, Reder M and Grossel MJ (2004) Science in the news: A study of reporting genomics. *Public Understanding of Science* 13: 309–322.
LaFollete MC (2002) A survey of science content in U.S. radio broadcasting, 1920s through 1940s: Scientists speak in their own voices. *Science Communication* 24: 4–33.
León B (2008) Science related information in European television: A study of prime-time news. *Public Understanding of Science* 17: 443–460.
León B (2006) Science news as marginal topic: European television channels compared. In: Willems J and Göpfert W (eds) *Science and the Power of TV*. Amsterdam: VU University Press, pp. 101–113.
Lewenstein BV (1994) Science and the media. In: Jasanoff S, Markle GE, Petersen JC and Pinch T (eds) *Handbook of Science and Technology Studies*. Thousand Oaks, CA: SAGE, pp. 343–360.
Löffelholz M (2009) Heterogeneous – multidimensional – competing: Theoretical approaches to journalism. In: Löffelholz M and Weaver D (eds) *Global Journalism Research: Theories, Methods, Findings, Future*. Hoboken: Wiley, pp. 15–27.
Lublinski J (2004) *Wissenschaftsjournalismus im Hörfunk: Redaktionsorganisation und Thematisierungsprozesse*. Konstanz: uvk.
Lublinski J (2008) dpa und WDR – Redaktionsalltag und Redaktionsforschung. In: Hettwer H, Lehmkuhl M, Wormer H and Zotta F (eds) *WissensWelten: Wissenschaftsjournalismus in Theorie und Praxis*. Gütersloh: Verlag Bertelsmann Stiftung, pp. 279–296.
Lublinski J (2011) Structuring the science beat: Options for quality journalism in changing newsrooms. *Journalism Practice* 5(3): 303–318.
Luhmann N (1981) *Soziologische Aufklärung 3: Soziales System, Gesellschaft, Organisation*. Opladen: Westdeutscher Verlag.
Luhmann N (1995) *Social Systems*. Stanford: Stanford University Press.
Maeseele P and Desmet L (2008) How? Like that! Science on television?! Paper presented to the 10th Public Communication of Science and Technology Conference, Malmö, 25–27 June.
Major AM and Atwood EL (2004) Environmental risks in the news: Issues, sources, problems, and values. *Public Understanding of Science* 13: 295–308.
Meier K (2002) *Ressort, Sparte, Team: Wahrnehmungsstrukturen und Redaktionsorganisation im Zeitungsjournalismus*. Konstanz: uvk.

Merten K (1973) Aktualität und Publizität: Zur Kritik der Publizistikwissenschaft. *Publizistik* Nr. 3: 216–235.
Napoli P (ed.) (2004) *The Impact of Regulatory Change on Media Market Competition and Media Management*. London: Lawrence Erlbaum.
Open Society Institute (ed.) (2005) *Television across Europe: Regulation, Policy and Independence*. Budapest: Open Society Institute.
Open Society Institute (ed.) (2008) *Television across Europe: More Channels, Less Independence*. Budapest: Open Society Institute.
Ott S (2004) *Information: Zur Genese und Anwendung eines Begriffes*. Konstanz: uvk.
Pellechia MG (1997) Trends in science coverage: A content analysis of three US newspapers. *Public Understanding of Science* 6: 49–68.
Rippl S and Seipel C (2008) *Methoden kulturvergleichender Sozialforschung: Eine Einführung*. Wiesbaden: Verlag für Sozialwissenschaften.
Rühl M (2002) *Organisatorischer Journalismus: Tendenzen der Redaktionsforschung*. In: Neverla I, Grittmann E, and Pater M (eds) *Grundlagentexte zur Journalistik*. Konstanz: uvk, pp. 303–320.
Scholz E and Göpfert W (1998) Wissenschaft im Fernsehen: Eine Vergleichsstudie 1992–1997. Unpublished research paper, Berlin. Available at (accessed 25 January 2012): http://www.uni-muenster.de/PeaCon/medkomp/kurs/scho_fobe.pdf
Shoemaker PJ and Reese SD (1996) *Mediating the Message: Theories of Influences on Mass Media Content*. New York: Longman.
Silverstone R (1984) Narrative strategies in television science: A case study. *Media, Culture and Society* 6: 377–410.
Traquina N (1995) Portuguese television: The politics of savage deregulation. *Media, Culture and Society* 17(2): 223–238.
Tuchman G (1973) Making news by doing work: Routinizing the unexpected. *American Journal of Sociology* 79(1): 110–131.
Ward D (2005) United Kingdom. In: Open Society Institute (ed.) *Television across Europe: Regulation, Policy and Independence*, Volume 3. Budapest: Open Society Institute, pp. 1601–1662.
Webster JG (2009) The role of structure in media choice. In: Hartmann T (ed.) *Media Choice: A Theoretical and Empirical Overview*, New York: Routledge, pp. 221–233.
Weigold MF (2001) Communicating science: A review of the literature. *Science Communication* 23: 164–193.
Weischenberg S (1992) *Journalistik. Medienkommunikation: Theorie und Praxis*. Opladen: Westdeutscher Verlag.
Willems J and Hanssen L (1993) Science and technology on TV: Four European countries compared. *Communications* 18: 215–221.

Notes

[i] Lucie Schiebel; Esa Väliverronen; Kostas Dimopoulos; Vasilis Koulaidis; Pepka Boyadieva; Yvonne Cunningham.
[ii] For further descriptions, please download "Definition of Science Programmes" from our website (http://www.polsoz.fu-berlin.de/en/kommwiss/v/avsa/Downloads/index.html).
[iii] For further information about channel selection please refer to "Code Sheet Programme Analysis" on our website (http://www.polsoz.fu-berlin.de/en/kommwiss/v/avsa/Downloads/index.html).
[iv] Germany, Austria, Sweden, Finland, Great Britain, Ireland, Greece, Bulgaria.
[v] Results of the pretests are published on the project website (http://www.polsoz.fu-berlin.de/en/kommwiss/v/avsa/index.html).
[vi] Peak hours were between 7 pm and 11 pm; in Spain between 8 pm and 12 pm.