

# CURRENT STATE AND CHALLENGES OF SCIENCE IN TODAY'S TV: A LOOK AT THE INTERPLAY BETWEEN SUPPLY AND DEMAND ON EUROPEAN MEDIA MARKETS

**MARKUS LEHMKUHL<sup>1</sup>**

FREIE UNIVERSITÄT. BERLIN. GERMANY

*Abstract: This study assesses the current state of science in TV and its future challenges. The assessments are based in substantial parts on a couple of comparative empirical media studies published in the last decade. The focus of these studies was either on the production of science contents in European TV, or on the reception of these contents by European Audiences. This paper integrates both perspectives into a comprehensive picture in order to unlock the basic interplay between supply and demand of Science in TV. It is diagnosed that the supply of specialised programmes is predominantly dependent upon financially strong and conveniently structured public service channels, especially the presence of small public niche channels is key to explain the considerable differences of programme offers across Europe. It is further diagnosed that the demand for these programmes by European audiences in general is not sufficient to stimulate production, of special relevance is the lack of appeal for younger viewers. We conclude by identifying main challenges TV producers face when trying to reach the largest possible audience.*

---

1. Corresponding author:

Markus Lehmkühl

Freie Universität Berlin

Institute for Media and Communication Studies

Garyastraße 55

14195 Berlin, Germany

Email: [markus.lehmkuhl@fu-berlin.de](mailto:markus.lehmkuhl@fu-berlin.de)

Keywords: *Science in TV, Science Audiences, People-Meter-Data, Focus-Groups*

---

*Resum: Aquest estudi avalua l'estat actual de la ciència a la televisió i els seus reptes de futur. Les avaluacions es basen substancialment en un parell de media studies empírics comparatius, publicats en l'última dècada, centrats bé en la producció de continguts de ciències a la televisió europea, bé en la recepció d'aquests continguts per part del públic europeu. Aquest treball integra ambdues perspectives en un quadre complet per trobar la clau de la interacció bàsica entre l'oferta i la demanda de la ciència a la televisió. Es diagnostica que l'oferta de programes especialitzats depèn predominantment de canals públics amb finançament fort i convenientment estructurats, essent especialment clau la presència de petits canals públics especialitzats per explicar les diferències considerables en la programació a tota Europa. Es diagnostica, a més, que la demanda d'aquests programes per part del públic europeu en general no és suficient per estimular-ne la producció, particularment en el cas dels espectadors més joves, que mostren una manca rellevant d'interès. Per concloure, s'identifiquen els principals reptes a què s'enfronten els productors de televisió quan es tracta d'arribar a la major audiència possible.*

Paraules clau: *Ciència a la televisió, audiències de ciència, audímetre, grups focals*

---

## Introduction

“While science-in-the media is a useful vehicle for understanding the media”, Jane Gregory and Steve Miller wrote 1998 in *Science in Public*, “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”. Science, they concluded, is not a special case in the mass media, understanding science-in-the-media is mostly about understanding the media (Gregory & Miller, 1998: 105). Almost two decades later, research which looks for patterns or even determinants of science-in-the-media, be it in press or electronic media, is still very rare. An interest in explaining the media’s selection of science content from a media perspective is weak. Instead, the search for, and analysis of, several kinds of distortions in media representations of science have been leading topics of science-in-media research since its beginning in the USA at the end of the 1960s and remains influential today (Lewenstein, 1994; Weigold, 2001; Kohring, 2005). Only a relatively small amount of research has sought to identify factors relevant to understanding how science is treated by the mass media in general and by TV in particular.

This is not surprising since the methodological requirements of studies which can contribute to a deeper understanding of science-in-media in general are demanding. They must be catholic in focus and comparative. Especially comparisons across countries can provide insights into the reason for degree and structure of the science thematisation. If you saw two

science news items in a prime newscast in Great Britain every day, but none in Hungary, Spain, Germany or Sweden, you had a suitable initial point of reference that allows you to say, that there are *comparatively* many science news item in the British newscast. That then provides a starting point to question why this happens to be so in that place.

The assessments of the current state of science on TV and its challenges that follow are based in substantial parts on a couple of such comparative empirical studies, which I have conducted in recent years (Lehmkuhl *et al.*, 2014; Lehmkuhl, 2013, Lehmkuhl, 2012; Lehmkuhl *et al.*, 2012, Lehmkuhl *et al.*, 2010). The perspective of these studies is not at all compatible with what concerns history of science studies. Their focus was on the production of science related contents in European TV from the point of view of journalism, defined as organized production of messages that can gain the attention of a disperse public. And their focus was on the reception of these contents by European audiences. In this study, I try to integrate both perspectives into a comprehensive picture of the current state of science reporting in TV and its challenges. This study focuses on the understanding of the constraints TV producers face when trying to attract audiences. In more theoretical terms: This paper tries to unlock the “duality of media”, using science on TV as example. This means that the same theoretical and empirical approach can also be applied to various other content areas.

### **Theoretical framework**

The term “duality of media” represents an adaptation of the structuration theory of Giddens. It refers to the basic interplay between supply and demand of media content: While people are free to tune into a science programme or any other programme on television, they can only choose from a limited body of programmes on offer, a structure of supply that, through their actions, they help reproduce and alter. Webster termed this basic interplay the “duality of media” (Webster, 2011; Webster, 2009).

An attempt to unlock this duality requires a theoretical clarification of the “media structure” that interplays with media users. In this context, the term refers to a pattern of science programmes offered by various television channels. To profile this pattern and to link it with specific, content-related media use, we need a suitable typification of science programmes that integrates the agency of media professionals *and* media users. A term commonly used in media studies is “genre”. Programme genres help media users find their way through various programmes. Genres raise expectations of audiences, supply needs and – at the same time - facilitate media production by helping to establish routines to satisfy audience expectations (Hallenberger, 2002).

Unfortunately, the term “genre” is only of limited value for defining the programme category “science programme” (Bonner, 2003). Since science finds its way into various programme genres, the term seems inadequate for concluding a contract between media professionals and their audiences. Magazine programmes, documentaries, even quizzes or

reality shows are used to raise awareness of science on television in Europe. Hence the term “science programme” is neither suited to describe specific expectations of audiences, nor to facilitate television professionals’ selection and reconstruction of science content.

Other available categorisations regarding science journalism are also ill-suited to mediate between production and reception of science on TV because of their science-centricity. The typifications of Haller (2008, 1999), Peters (1994) and – to a lesser degree – also of Secko *et al.* (2012) are guided by the differentiation of the image of science that appears or of what type of science is prevalent in reports. There is less or no focus in these classification attempts on journalistic constraints that arise from the dependency on a large, non-specialist audience for journalism that must be reached by producers in order to pay back the investments in the programme.

The main theoretical challenge thus lies not primarily in the definition of what a science programme actually is. This can be done by a nominal definition. In this context, a science programme is defined as:

- a) a programme that reports on research findings or events related to the natural and social sciences, humanities or to applied sciences such as engineering and medicine (Bauer, Petkova, Boyadjieva, & Gornev, 2006; Bucchi & Mazzolini, 2003) **and/or**
- b) a programme that links scientific expertise or scientific findings related to the natural and social sciences, humanities, or applied sciences such as engineering and medicine with social, political, economic or everyday topics (Hijmans, Pleijter, & Wester, 2003).

A programme is considered a science programme if it mainly or exclusively covers science content in one of the ways stated.<sup>2</sup>

The main theoretical challenge is to achieve a meaningful breakdown of the heterogeneous body of programmes covered under this nominal definition by the routines they use to establish and protect the bond with their audiences. In this context, we need to turn to theories on how journalism protects its bond with audiences in general and with science audiences in particular, and the different ways in which organisational units like science programmes are trying to attract attention for their products.

Basically, journalism in general is guided by the necessity to gain attention for its products (Luhmann, 1981; Gerhards, 1994; Görke, 1999; Kohring, 2005). Attention for messages depends on the informational value. A statement is informative if it is “new”, i.e. if it was previously unknown to the recipient (Ott, 2004). Attention also depends on the relevance to the recipient (here relevance is understood in the broad sense of being useful for whatever sake). Only what is informative *and* relevant, can gain attention (Merten, 1973).

---

2. For further explanation, please download “Definition of Science Programmes” from our website. [www.fu-berlin.de/avs](http://www.fu-berlin.de/avs)

Informational value depends on the context and is in the eye of the beholder. What is new and relevant for a certain 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 of disperse publics, producers must follow routines in their selectivity. These routines serve to protect the bond between journalism and its audiences (Rühl, 2002). Lublinski (2004, 2008, 2011) studied three German radio science programs and a news agency extensively through participant observation. He summarised numerous routinized journalistic actions by the term “editorial concept”.

Basing on these theoretical considerations we have screened TV science programmes in 11 European countries that were broadcast between 2007 and 2008 on channels that reach an accumulated market share of 85 per cent in each country (Lehmkuhl *et al.*, 2012). We typified the 439 programmes identified empirically by distinguishing five different editorial concepts, i.e. different ways of how these programmes try to produce new and relevant messages. Three of these concepts will be discussed in greater detail:

### A Information Programmes

These programmes tend to be produced by journalism that is specialised in observing news from the field of science, choosing those that seem especially useful to its audience, for example because they concern many people, and processing the selected topics quickly. Another characteristic of this type of programme is that it is specialised in the linkage of relevant non-scientific news items with science. This is the case when, for example, a natural disaster happens, toxins are discovered or the stock exchange crashes. To gain attention in this case, programmes are forced to gather quickly scientific background information about an event or the context of an event and to broadcast it. Accordingly, features within this programme type are very often prompted by current events from within the science system. Furthermore, recent events from within other social systems or the physical world (catastrophes, for instance) often prompt media products in this programme type.

The short preparation time determines how the selected topics are processed. Highly standardised genres such as news reports are commonly used by programmes in this category. Also used are genres which do not need a long preparation time, such as interviews or discussion between the presenter and a reporter/journalist in or outside the studio.

Constraints of short preparation time are also reflected in the average lengths of the items within this programme type. These programmes tend to concentrate on shorter items, not longer than seven minutes. Short preparation time, specialisation in observation of current events from within the science system and more items per episode compared with the mean of all other programmes implies that these programmes cover a variety of themes per episode and they focus more strongly on themes than on a scientific discipline.

Because of its close relationship to current events and the lack of a specified need to be fulfilled by these programmes, we will call this type of specialisation “Information on

Science”. The programmes fitting this category we call **“Information Programmes”** (on Science).

## **B Popularisation Programmes**

These programmes tend to be produced by journalism specialised in stories which are not new in a chronological sense but which belong in the wider context of scientific fields. Examples are documentaries about the birth of black holes, the origin of humankind, the history of the theory of relativity, in other words, stories on more or less big themes in science. They attempt to offer deeper insights into fields of science that would otherwise be closed to wider publics. Accordingly, these programmes are characterised by long preparation times and concentration on a focal theme. This kind of programme faces a completely different challenge from that of Information Programmes.

The main challenge does not lie in the selection of relevant scientific news and a quick reconstruction, but in the development of communication techniques which engage the media user with a topic relatively intensely. Generally this type of programme has no convincing answer to the question of why a media user should engage with relativity theory, black holes, the Egyptians or human evolution today of all days. It needs more airtime and demands more attention than a concise report. Two thirds of items within this programme category are longer than 20 minutes. The large majority belongs to the genre “documentary”.

This form of relaying information can be seen as an effort to depict science as a fascinating journey to the frontiers of knowledge or as an adventure. This is sometimes even evident in the titles. One of the most common means to spark and kindle fascination is to reconstruct the actual process of finding, to retell wrong turns that were taken, to depict scientists like the heroes of a drama. The dramatic arc in this case is generated through asking questions that are supposedly unanswered. In the course of the programme the questions are addressed and answered, which creates the impression of witnessing the solving of a mystery. What creates the fascination here is either the sensational property of a question or the sensational way in which answers are found, or both. This produces an appearance of adventure that is to a certain extent typical for these formats (Collins, 1987; Silverstone, 1984).

Even more than information programmes the thematic focus of the items within this category is on science. The content can clearly be linked to the formal production of scientific knowledge within disciplines and scientists appear far more as main actors than in other programme types. This corresponds with what has been said about the important role scientists play in the narratives developed. Thematically, this programme type focuses more often than other programme types on humanities, i.e. predominantly history and archaeology, which have been classified as humanities. This type of programme is specialised in the neat relaying of scientific insights and we will call it therefore **“Popularisation Programme”**.

### C Edutainment Programmes

Programmes can also specialise in using unfamiliar scientific explanations to enrich people's experience of things that are, in a broad sense, part of their everyday life. This type of programme often answers questions such as why the sun goes down, why one gets wet more quickly in the rain when running, what happens if one places a broom stick into a specially prepared blender or sticks one's head into a bubble of helium. The selection of topics, unlike in information and popularisation programmes, is not at all guided by developments within the science system.

These programmes face the task of delivering surprising connections between everyday phenomena and scientific explanations and presenting those explanations in an accessible way. Accordingly, features of programmes in this category are more often prompted by people's realm of experience. The selection of topics, therefore, is hard to organise for media professionals as it cannot be guided by the observation of sciences or other social systems but rather by a programme's specified need. This is the main reason why in many of these programmes recipients propose the topics to be explained. Selections of these programmes are frequently not processed in ways that can be grasped by referring to journalistic genres.

Programmes of this type are characterised by a relatively high share of items that show no link to science at all, i.e. scientific explanations are often only one part of the whole programme. Scientists appear less often as main actors, and entertainers such as singers, artists or sportsmen appear more often than in any other programme type. We will call this type of programme "**Edutainment Programme**" because of its primary outcome orientation, which targets entertainment or education of recipients or both.

Using these rough distinctions of editorial concepts, I would like to go on to describe the current state of science on TV below based substantially on juxtaposing the supply of these programmes in eleven European countries (Lehmkuhl *et al.*, 2012), the use of these programmes by aggregated audiences in ten European countries (Lehmkuhl *et al.*, 2014) and on selected judgements of audiences derived from 40 focus group discussions conducted in five European countries between 2009 and 2010 (Lehmkuhl *et al.*, 2010).

### Current state of science programming in Europe

Television in Europe is generally characterised by relatively few specialised programmes that would qualify as information journalism, i.e. those that pick up recent events in science and process them into news-shaped journalistic products. About seven per cent of the 439 science programmes that have been broadcast in 11 participating countries<sup>3</sup> between 2007 and 2008 are dedicated to information journalism. Hence, the chances for new scientific findings to be picked up by a specialised TV science journalist and published are slim in Europe.

---

3. Germany, Austria, Finland, Sweden, Estonia, Greece, Spain, Bulgaria, France, Great Britain, Ireland.

To understand what this means, one has to be aware that information journalism on science requires a specialised editorial unit to provide relevant news from the realm of science *regularly*, 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, it accumulates expertise; it develops efficient routines to find relevant news items, it develops assessment valuation standards that serve to distinguish relevant from irrelevant news items; it accumulates knowledge about research progress in the particular fields of science observed (Lublinski, 2011).

It does not mean that science news is never on television if these specialised programmes did not exist. In fact, science items can be regularly found in television news (León, 2006, 2008). It rather means that there are only few units in Europe, that are *specialised* in the handling of science news items in the before mentioned way.

Subsequently, television is organisationally ill-prepared for the handling of new science findings. Usually, television is totally surprised by potentially ground-breaking findings. From virtually nowhere a significant finding suddenly appears, and in the face of the evident importance, the news editors absolutely have to report on it. But they do not possess any established routines how to do this. Instead, they apply the routines they use with their bread-and-butter issues of politics or economics, but unlike political events, they have little expertise in communicating science news in a high quality way due to the lack of specialisation. To achieve high quality, thorough background knowledge is indispensable. Without this background knowledge, for example, it is not possible to evaluate scientific findings. In some cases, the extensive lack of specialised units can have far reaching consequences which is well exemplified by the case of the “Venus of the Swabian Mountains” (Lehmkühl, 2009a).

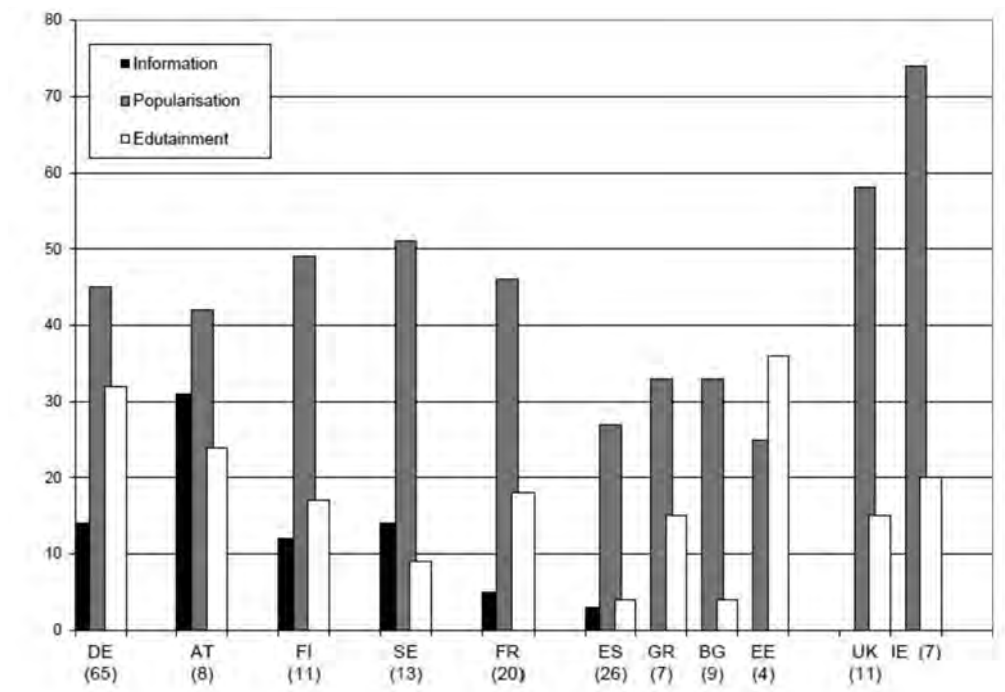
As table 1 indicates, information programmes are not evenly distributed in the 11 countries analysed. Only a few countries have specialised editorial TV offices at all, and hence specialised expertise for the selection and publication of science news. Among those are Germany, Finland and Sweden (Austria is a special case that is discussed in detail elsewhere Lehmkühl, 2012). In these countries programmes are established that address science news regularly.

The lack of specialised editorial offices means that the specialised treatment of science news constitutes a threshold of specialisation that TV can only cross in exceptional cases. Specialised editorial offices have only been found on media markets, which have two features in common:

- a) They own thematically specialised public service channels that can live off with low market shares between one and five per cent market share, and (closely related)
- b) public service broadcasters do not depend substantially on advertisements and are comparatively well funded by a fee.



Table 1. Distribution of Science Programmes in Europe in per cent airtime



The table shows the percentage of airtime in an average week between 2007 and 2008 dedicated to the three programme types considered here. In brackets the total time per country dedicated to all science programmes in hours per week. DE: Germany; AT: Austria; FI: Finland; SE: Sweden; FR: France; ES: Spain; GR: Greece; BG: Bulgaria; EE: Estonia; UK: United Kingdom; IE: Ireland.

The popularisation of science compared to information journalism in television is much further developed as measured by the number of programmes and the share of airtime dedicated to this type of science journalism. In 262 of 439 TV programmes that have been counted in 11 European countries, science was popularised. As was the case with information programmes, popularisation programmes are not evenly distributed across Europe. Differences of supply of this programme type across countries are - by and large - associated with the same factors as was the case with information programmes. These programmes generally deal with a single scientific theme or thematic area without any topical relevance that is edited in a more or less complex way with the means of television. Many of these programmes have been and are distributed Europe-wide, especially BBC series, for example "Planet Earth" or "The Planets."

Accordingly, in science popularising journalism individual programmes or series with four to twelve episodes dominate the market - very different to information programmes that used to be scheduled weekly or even daily on a regular basis. Unlike information pro-

grammes, the popularising programmes are not backed by an editorial office in the classical sense. In that respect the number of programmes does not indicate the existence of a specialised editorial office (as it would with information programmes), because in theory every channel can distribute a multitude of these programmes, without employing a single TV author, that produces such content regularly and subsequently could be considered specialised in the communication of timeless beautiful science matter with mass appeal.

Whereas the information programmes prefer stories related to medicine, the structure of topics is completely different in popularisation programmes: history, palaeoanthropology, archaeology and contemporary history prevail. About 50 per cent of all popularisation programmes address these topics. After a big gap, physics, especially astronomy, follows with 13 per cent of programmes of this type. This means that the thematic restrictions in popularising programmes are great. Not every scientific topic has the same chance to be popularised through TV.

As is the case with information programmes, the lion share of programmes are broadcast by small (1-5 per cent market share) public service channels though with the exception of Ireland and the UK, both countries that cannot be classed to countries with a segmented market of free to air public service channels.

Apart from the UK, where the lion share of science programmes was scheduled on Channel Four and Channel Five, commercial channels did not contribute substantially to the provision of science programmes in general. They account for 20 per cent of all science programming in our sample of countries. The supply of commercial channels is – again apart from the UK – dominated by Edutainment Programmes that seem to be the only type outside the UK that is interesting for commercial TV stations.

In edutainment commercial TV succeeded especially with advertisement-relevant target audiences. A good example was the Spanish programme “El hormiguero” on the station Cuatro in which a likeable, mad scientist character named Flippy demonstrated spectacular experiments to millions of Spaniards. Worth mentioning are also some formats that were developed in Germany: “Clever”, “Galileo” or “Wissenshunger”. That 56 per cent of the 80 million Germans have seen at least one episode of “Galileo” within the period of one year highlights the popularity that these programmes can gain in some cases. That makes “Galileo” the science programme with the biggest coverage in entire Europe.

It is notable, especially regarding the commercial programmes of this type, that they connect scientific explanation with every day phenomena in only a limited way. They no longer aim primarily to provide the viewers with a light-bulb moment, when they learn that the dancing water drops on the hob have something to do with the water’s surface tension for example. Instead, these programmes aim rather for the wow-factor, by manipulating the every day phenomena that are to be explained, in such a way that they become spectacular. This is the case, when the braking force of common car breaks is demonstrated by braking a car by parachute. This is also the case when the power of a household blender is docu-

mented by first preparing it so that a broomstick fits into the blender and bursting the broom stick with the force of the blender.

Also fairly typical for commercial edutainment formats is that it uses a broad definition of what counts as everyday experience and subsumes under this also phenomena that are from the realm of the mysterious. These “mysteries” can be assumed to be known by many people. Such “phenomena”, like Chakras or time travel, are then (para-)scientifically explained, sometimes with scientific experts taking on the role of explainers. There might be an argument here that such programmes cannot be included in the catalogue of scientific formats. One argument against the exclusion of these programmes is that their narrative techniques have entered into classic science programmes (Lehmkuhl, 2008).

However, edutainment is a German speciality. By far in no other country so much airtime was dedicated to this editorial concept. One factor, although difficult to grasp, that explains the exceptional role of Germany in this programme segment may be the tradition of science reporting in audiovisual media in Germany, which was since its early days strongly connected with programme formats which today we would class as edutainment programmes (Cube, 1994). But we know little about the historical roots of science programming, which can be connected conceptually with preferences regarding how scientific information is selected and broadcast by producers. It remains therefore rather difficult to assess to which extent understanding differences in the traditions of science broadcasting in media contribute to a deeper understanding of the choice of programme types.

Easier to grasp is one difference of Germany compared to all other countries in our sample: The comparatively big number of mid-sized commercial channels that can live off with market shares between 5 and 10 per cent, which – of course – correspond to the size of the German market with its 80 million inhabitants. 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 in general was allotted by mid-sized commercial channels. This means that volume of supply especially of edutainment corresponds with a characteristic of national TV markets as was the case with popularisation and information, the existence of mid-sized commercial channels obviously increases the probability that edutainment programmes are offered.

### **The interplay between supply and demand**

In the previous paragraph we have identified some characteristics of national media systems that can be linked to the structure of supply of science on TV. Next we will expand the analysis by integrating data on the use of these programmes in Europe. This is especially relevant for the TV market that is driven by various audience measuring tools, the most important of which are daily television ratings derived from people-meters (Koch-Gombert, 2010). These measuring tools actually enable a vivid interplay between supply and de-

mand. I propose to treat aggregated audience data as the most relevant currency for producers of TV content. Of special relevance are data from young audiences, aged between 14 and 29.

Particularly commercial channels view their audiences primarily as merchandise to be offered to the advertising markets. Young people are of particular interest here, since their consumer behaviour and needs are considered more manipulable than those of older people. Particularly for public television, young audiences play a significant role in assuring the channels' very legitimacy: almost Europe-wide, public television is bound by the double normative mission of appropriately integrating science and education into its programme portfolio, and reaching all age groups in society in order to act as an integrating force (Open Society Institute, 2005; 2008).

The analysis of people-meter data derived from several countries in Europe is a complex methodological issue that is described in detail elsewhere (Lehmkuhl *et al.*, 2014). We managed to create an artificial subsample of ratings of science programmes, which enables meaningful comparisons of ratings of different programme types. The sample controls important factors that influence audience rates independent of content, namely the viewer awareness (programmes scheduled on small channels have not the same chance to reach as much people as programmes on big channels), the number of channel options in a country, and the viewer availability that refers to seasonal, weekly or hourly variations of the size of the potential audience.

By using this sample, I will firstly compare the average rates each programme type category reached between 2007 and 2008.

Table. Average viewing rates by programme types in 10 European countries\*

<b>Programme Type</b>	<b>Average Viewing Rate in %</b>	<b>Standard Deviation</b>	<b>Number of Programmes</b>
Information	1.9	2.1	10
Popularisation	1.2	1.5	115
Edutainment	1.3	1.6	43

\*Austria, Bulgaria, Estonia, Finland, France, Germany, Greece, Ireland, Spain, Sweden

The differences between the three programme types considered here are slim, the average rates do not differ significantly. Hence, there is no evidence that the bare size of audiences can be related to the programme type offered. The same is true when we consider the average share especially of young audiences (14-29).

Table. Average share of young viewers (14-29) by programme types in 10 European countries

Programme Type	Share of Viewers 14-29 in %	Standard Deviation	Number of Programmes
Information	9.6	6.2	10
Popularisation	11.1	10.4	115
Edutainment	15.8	11.1	43

Though on average the share of young audiences watching edutainment programmes is considerably higher than the share watching information programmes, the differences are not significant. This is certainly due to the low number of information programmes. However, there is no convincing evidence that the low shares of young science audiences are related to any specific programme type. Instead - with regard to the production sphere mostly relevant - the programme category "science programme" as a whole did not appear to be attractive to young audiences. Every single science programme type in all ten countries reached a considerably lower share of young people when compared to their share of the overall population. The share of young science audiences is between 7 basis points (France) and 15 basis points (Greece) lower. Apart from Austria and Ireland, even the share of people aged between 30 and 49 is considerably lower than their share of the overall population (-12 to -7 basis points).

I will finish this snapshot on audience data by coming back to the meaning of the actions of aggregated audiences for producers. To those in charge of making programmes, the young viewer segment is almost intangible as an aggregate group, as a definable segment of a mass audience with differentiable preferences regarding media reconstructions of science related contents that can be addressed by producers. Only edutainment programmes seem to have a certain appeal to audiences younger than 50.

By taking into account that aggregated actions of audiences help reproduce and alter the structure of supply of science on TV, we found no convincing evidence that audiences inspire the production of science contents in TV on this macro level of analysis. On the contrary, if content production would exclusively be led by audience measures, we had reason to expect a decline of science programmes on offer on a European level. This affects foremost information and popularisation programmes, which lack appeal for younger age groups.

Before starting to conclude on challenges faced by producers of science content, we will try to substantiate our quantitative audience analysis further by selected outcomes of focus group discussions. A team of researchers and I conducted 40 focus group discussions each with 8 -12 participants in five European member states: Germany, Finland, Greece, Bulgaria and Ireland. The composition of the groups was varied regarding a) the

direct access to science (scientists, science teachers, amateur scientists...), b) age and c) education.

The focus group discussions were designed to contribute to an understanding of why participants engage with science through regular selection of science contents in TV and other media. They do it across countries because of

- a) the perceived personal functionality of science in media
- b) perceived own personality traits (curiosity)
- c) perceived characteristics of the medium TV that transmits science content.

In addition, the focus group discussions brought up a set of judgements relevant for understanding the reception of science content dependent upon the programme type.

The discussions reproduced a battery of gratifications audiences expect and receive by watching science on TV which have been reproduced repeatedly since the early 1970s, for instance “Getting insights into something new” or “Becoming inspired to search for further information” or “Gaining interesting things to talk about”(McQuail, 2010). Interestingly, we could not identify any motive, need or gratification that can be linked exclusively to science contents. Instead, expected and received gratifications appear to be applied to the medium TV rather than to specific non-fictional TV contents. Insights into the motives of audiences to watch science programmes are thus not promising with regard to our main interest here, the interaction between supply and demand of science contents in TV.

Promising are the judgements expressed in the discussion groups of each of the three programme types. I will focus especially on statements that illustrate the main challenges of the three different programme types or editorial concepts from an audience point of view. The aim of this analysis was to unfold relevant criteria, which are applied to express specific strengths or weaknesses of the different editorial concepts. These statements have been provoked by showing short clips of each programme type.

The very open question about what they think of the clip led to a multitude of criteria, against which the programme clip has been judged. Instead of repeating all criteria, which are published elsewhere (Lehmkuhl *et al.*, 2010), I will focus on those that appeared to be of crucial importance for the judgments of each of the programme types and will illustrate it by some quotes from the discussions.

To provoke judgements that can be linked to information programmes, we showed – according to numerous studies (Bauer *et al.*, 2006; Bucchi & Mazzolini, 2003; Einsiedel, 1992; Pellechia, 1997) – typical science news reports, i.e. reports on new medical findings that are promising in the sense that they may lead to a cure, a vaccination or more generally to progress. But the results are yet to be confirmed, the actual practical meaning appeared to be ambivalent.

The most important criteria against which negative judgements have been expressed in

all five countries were the meaning of the message, which was unclear. Some Greek participants felt that the medical breakthrough should not be presented as if the solution is already there, otherwise the message could raise false hopes: "There is an ethical dilemma however – scientists have responsibility when presenting a health topic."

The unclear meaning of the message made some Bulgarian participants wonder about the motives of the production team. The same applies to some groups from Finland and Germany. Participants tried to find "a motive" for presenting such news. They oscillated between a conspiracy theory (purposefully presenting the story), spreading fear, urging people to buy vaccines, which would be in the interest of the pharmaceutical companies. The unclear meaning of the message led Irish participants to judge the news report as "filler inner" which would be used on a "slow news day".

German participants shared this impression. One quote taken from a German discussion group well exemplifies the critical judgments in many groups across countries:

"When something like this gets broadcast in the news my expectations are that something meaningful had happened that should easily be described in two or three sentences – the way news are generally structured – and will give me information on something that will have a positive effect on me. This was simply a filler, providing zero information. 'Could be, could not', looked somewhat appealing, they (the editorial team) filled in the time, they had the topic (AIDS) – and that might actually be the only positive aspect about the whole thing: we're still aware of this topic and are still conscious about the severity of it."

This quote summarises crucial findings of the focus group discussion as far as news shaped information on science on TV is concerned. The critical judgments focus predominantly on the lack of meaning, but the critical judgments are somewhat moderated by the importance of the issue that is addressed. In all countries participants judged the importance of the topic itself, i.e. the disease in question highly relevant and relativized critical statements by mentioning the general relevance of the topic.

It is evident that the expectations of the participants in focus group discussions regarding science on TV are impossible to meet by reports on single scientific findings especially as far as biomedicine is concerned. There might have been single papers, which contained a "solution" in the past, but this character became never apparent when the paper was published. The expectations of participants in focus groups are definitely not in line with what is possible by news reporting on science. This may serve as an indicator that affects the structure of supply as far as information programmes are concerned.

Crucial for the judgments of the popularising clips (cuttings from typical high cost documentaries on astrophysics, evolution and paleoanthropology) was the topic selected. In all groups across countries the topic is the dominant criteria against which popularising TV

contents are judged – positively or negatively – followed by the way of the presentation, which has been both praised and bashed. The polarisation of judgements referring on the topics and on the way of presentation became particular evident in Germany, Finland and Ireland, all marked by a considerably bigger number of popularising programmes on offer compared to Greece and Bulgaria.

Irish participants in some focus groups enjoyed the clip on evolution uniformly, whereas participants in other groups did not like it at all and “couldn’t wait for you to switch it off”. This was due to the topic chosen as some participants felt evolution had been “done to death”.

For Finnish participants who watched a high cost documentary on black holes interest on the topic seemed to have a considerable influence on participants’ comments about the clip. Most groups seemed to be divided between those who were very interested in cosmology and those who were not interested at all. Those who don’t usually watch space documentaries tended to be critical and found the clip uninteresting and would not have watched the documentary at home: “I almost started to laugh in the beginning. This is an area of science that interests me less than anything else. It is so far away from my life, I don’t even understand what is the use of the black hole, what can we do with the knowledge about it?”

German participants who watched a clip on paleoanthropology also praised and criticised the topic. As in Finland, interest in the topic field was the most important criterion. The critics referred primarily to the specialisation of the topic, which requires vivid interest for the subject matter. “Well, this might be an issue for someone who’s just read a lot of books on the history of the development of mankind, Darwin – pretty interesting. But I don’t see a real benefit in there for me. I link everything to benefit and to the advantages humanity derives from it. It’s a programme to watch, but not much more.” Or: “That topic doesn’t have anything to do with general knowledge in my opinion – that’s something you learn in school – what would be general knowledge in regard to archaeology and the finding of some kind of ape is not really general knowledge. I’m interested in sciences, I would say, but rather in like general science, not specifically (...) archaeology and that’s why I would have turned it off.”

This leads to the conclusion that the importance of the topic for the selection of a popularising programme is the main factor worth considering when trying to unfold the interplay between demand and supply. Everywhere in Europe popularising programmes are very rarely broadcast during prime time by big channels that must reach more than 10 per cent market share. Popularising programmes can only cover one specific topic, however popular this topic might be, it can hardly be calculated whether the popularity of the topic is high enough to jump a hurdle of more than 10 per cent market share or even more. In addition, the relevance of the topic for the success of a programme explains why European broadcasters concentrate so much on historical topics.



To provoke judgements that refer to edutainment programmes we showed clips that provided scientific explanations on “why champagne bubbles?”; “why we need to sleep?”; “why it is difficult to make computers learn?”; “why water drops tend to ‘dance’ on a hot-plate?” and “why lightning is dangerous and how it can be explained”. As in the earlier cases, the clips and the open question of what they think about them provoked various judgements as it was the case with the other programme types, but unlike information and popularisation programmes we could not identify a criterion against which the clips are judged predominantly.

However, apart from Ireland all groups across countries appreciated the relatedness of the topics to their daily lives, but though the topics address every day phenomena and try to make scientific explanations relevant, many groups questioned how relevant the explanations really are. This became particular evident in Finland and in Germany. Some Finnish and German participants judged the clip trivial, childish or ridiculous since the topics addressed lack importance or – as a Finnish participant stated - are too “small”:

“I’m not interested in such small things. It is targeted to different kind of people (giving a laugh) who are interested in such small things instead of being willing to understand anything bigger...”

The judgments of many participants especially in Finland and Germany are marked by ambivalence. On the one hand they applied the criterion of the relatedness of the topics to their personal lives, against which the stimuli are judged positively. On the other hand they applied the criterion of the importance of the explanation, in order to qualify their judgement substantially. This ambivalence is illustrated well by a quote taken from a discussion in Germany:

“Do I really want this information? I’m leaving undecided! But when I see this I’m thinking ‘oh! It works like this as well’ but you don’t reflect on it beforehand...”

To sum up the judgements in most of the focus groups, edutainment programmes are appreciated for providing a light bulb moment, but the importance of this moment, the importance of the explanation is assessed to be rather small, if not trivial. This tendency is well illustrated by a summarising statement taken from a German discussion group:

“Well, I liked it (the programme from which the clip was taken) as a short teaser, right before the news programme but: I wouldn’t watch something like that for a whole hour – I simply wouldn’t! But a short teaser like that, sure, why not? It makes me think for a while and then I think: ‘ok, that was it for today’.”

When we try to link these insights with the structure of supply it becomes understandable why especially popular edutainment programmes depend heavily on the context in which the explanations are embedded, a quiz, a reality show, a family show. It appears to be unlikely that edutainment can gain the interest of audiences when just concentrating on the accuracy or comprehensibility of the explanations and/or on the relatedness to every day experiences. It requires something more to gain attention of TV audiences for scientific explanations.

### **Challenges of science on TV in Europe**

I would like to conclude with a look into the challenges TV producers face, guided by the insights into the interplay between supply and demand of science contents in European TV. I would like to start with the specialised information journalism that has to fight with structural problems.

From a normative perspective, information journalism is understood to have an important societal role because it scans research for events that have at least the potential to be relevant for others outside the field of science that it concerns, such as politicians, that want to reform pensions, health and traffic systems, or entrepreneurs, that want to market innovation, or even scientists that are alerted to trends relevant to them in other disciplines, or people that are suffering from a disease or look for orientation (Field & Powell, 2001).

From the perspective taken in this study, i. e. the perspective of TV journalism that is forced to produce science news regularly that can gain the attention of a TV audience, producers face the problem to meet the normative expectations due to primarily one character of the object under consideration: new research findings are almost always essentially ambiguous, in the sense that their practical meaning - lynch pin of their societal relevance - is rarely clear at the time of reporting. Set phrases are abundant in information journalism; such as: the result, breakthrough or cornerstone *xyz could* lead in three, five or ten years to this or that. It might be possible to avoid such set phrases. But producers of science news cannot avoid the dilemma that new scientific research needs to be relevant for a diverse public, but that this relevancy is almost always uncertain as far as new single studies are concerned. TV producers cannot count on attention if they need to burden their constructions with “mays” or even “mights”. “Scientific uncertainty per se is not attractive to journalists” (Kitzinger & Reilly, 1997:344).

It is exactly this structurally determined property that makes it unlikely that science information journalism could overcome its very marginal position in the foreseeable future, as long as this journalism mainly sees itself as collector and evaluator of (natural) science news who are specialised on the selection and quick reconstruction of things that appear in *Nature*, *Science*, *The Lancet* or *PNAS*. This concept will survive or die with news journalism in general as a marginal phenomenon; real impulses for the future are not to be expected from this concept.

It may be assumed that a gain in status of information journalism depends on its success in raising topics that are highly relevant to society. Ideas, how this could happen, do exist. One such idea is to design information journalism as a watchdog of science. Such ideas can be challenged as they do not consider the expectation of the audience, nor the structural difficulties that stem from the specialisation of the sciences. Journalism would be overwhelmed by the role as a science watchdog.

Other ideas have to be judged differently. These propose to use the accumulated expertise of specialised editorial offices to connect relevant societal topics much more than previously with scientific expertise, or to communicate new insights into relevant societal problems, respectively. This concept had already been discussed in the 1980s by the German philosopher Helmut Spinner (1985). The core of these concepts is to make science usable as decisive resource for investigative inquiries. According to this concept, journalists would no longer proclaim the government's political declaration but also at the same time do a kind of science-based check of rationality, to uncover its ideological contents. This would without question accommodate the increasing need for orientation of its clients.

These concepts, however, would mean a radical change in observational angle. The search would no longer be event-related (to new scientific studies) but instead problem-related – with respect to relevant scientific expertise. Not journalistic experts in certain scientific disciplines would be in demand but excellent investigators with scientific expertise in many disciplines including especially the social sciences and humanities. Furthermore, journalistic expertise would not be organised into science departments but instead all reporters need to possess scientific expertise.

There are many reasons to doubt that such a radical change would be possible within the current structures. But in my view there is no doubt that the challenges of the specialised information journalism will not primarily be addressed in the few TV science units but in the editorial offices of politics and/or business. This applies to all media, not only to TV. The TV information programme of the future will rather follow the format of the US show “Frontline” ([www.pbs.org/wgbh/pages/frontline](http://www.pbs.org/wgbh/pages/frontline)) than the classic “*Vetenskapsmagazinet*” on Swedish television or “*Nano*” on German TV. They practice investigative journalism that uses scientific expertise on a case-to-case basis.

The main content related feature of *popularisation programmes* that serves to understand the contemporary interplay of supply and demand is their focal theme approach. Pivotal to all popularisation programmes is their focus on one single scientific topic that is costly constructed and their need to keep the attention of TV users for a relatively long span. This character explains well why these programmes are extremely selective in their choice of topics and why reliably reaching big TV audiences is so challenging for these programmes.

It is unlikely that popularisation-programmes can overcome this restriction in the future. This would be different, if journalism suddenly were in a position to re-evaluate popularisation with topical references.

What conditions are needed for this to happen and what possible consequences this opportunity would have for public attention and for science itself, can be demonstrated with the examples of science-media-partnerships (Nielsen, 2009) for which the case of *Ida* is a good example. *Ida* is a primate fossil that kept not only information journalists all over the world busy in the summer 2009 but was *at the same time* popularised through a book and a television documentary. I do not know of any other case in which a single scientific finding has received so much attention. By autumn 2009 the scientific article that describes the findings had been downloaded over 100,000 times from the server of the online-magazine *Plos One* (Franzen *et al.*, 2009; Lehmkuhl, 2009b; Mäder, 2009). This makes it probably the most popular scientific publication of a single finding that has ever been published.

Although especially popularisation programmes may be amenable to science-media-partnerships it cannot be expected that such partnerships will solve the main challenge of engaging big audiences. This, of course, does not mean that popularising contents in the long-term will be produced in the same way they have been so far - it is rather very likely that maybe innovation in camera technique or something of that kind will result in new possibilities in visualising or the like. However, this does not essentially change its basic conceptual orientation. The main concern in the future will still be to find the largest possible audience for a specific science topic of timeless beauty.

Currently, the degree of popularisation in non-pay TV depends largely on the supply side on the number of specialised public service stations that can live off or make do with a market share of between 1 and 5 per cent. The more such stations are available in a country, the more popularising programmes are broadcast. This applies to those European countries whose markets are big and/or whose public service broadcasting is financially relatively well equipped. Especially the thematically specialised public service broadcasters are dominant in the popularisation on TV; this is especially visible in Germany, France and Scandinavia. Considerably more popularisation can be expected in the near future in Great Britain due to the establishment of digital special interest channels supported by the BBC from a very big available pool of popularising contents. Especially in Great Britain the degree of popularisation in 2007 and 2008 was still limited due to the low number of free to air TV channels.

This suggests that a Matthew effect will apply in popularising TV-contents: Those who already have are given even more. The situation in South and East Europe is different and more difficult. It is to be expected that the segmentation into niche TV channels would have a similar effect, but there is reason to doubt that a comparable niching into special interest public channels will occur at all. The public service broadcasters in these countries are generally very under-funded and the markets for national commercial niche channels are too small. The German market is the only market in Europe in which commercial broadcast associations entertain also niche channels that have popularising contents to an appreciable degree. And even there, the channels are usually loss-making. It can therefore be assumed

that more popularising content in these countries would only be possible with operations/activities of foreign-based broadcasting associations. This certainly will have no or little effect on the amount of popularisation that is produced in these countries.

*Edutainment* has the greatest potential, conceptually as well as economically. Edutainment in Europe is rather dynamic. This is evidenced by the fact that new formats are published regularly. The reason for this is twofold: edutainment offers a new option to re-evaluate established TV genres such as the family show, the quiz show and even reality TV in regard to concepts and contents. Furthermore, the combination of existing TV genres with explanations offers the possibility to plan the popular success of these developments more reliably than that is possible with popularisation which appears to be heavily dependent upon the topics selected.

For this reason, edutainment is an option to cover the segment of science especially for commercial providers. Public service broadcasters are less dominant in edutainment than in any other type of science journalism. The potential that this type in all its variations has for TV is not exploited in all European countries as our comparison has shown. The stronger establishment of edutainment (unlike popularisation) is not prevented by primarily economic constraints in Scandinavia, East or Southern Europe. Additionally, the popularity of edutainment is not confined to a clear-cut cultural area, as can be seen in the successful internationalisation even outside the borders of Europe of German formats such as “Clever”. Thus, we can expect that the presence of edutainment in European television will increase in the medium-term.

But this does certainly not mean that this is of any societal relevance. Each of the concepts distinguished here includes a body of programmes that are to some extent quite heterogeneous and differ from each other in various ways within the categories we selected for this study. This is particularly true for Edutainment, which enjoys the highest share of young viewers.

There are many different ways to link concrete scientific explanations to real-life experiences in the broadest sense. The English programme “Rough Science”, for example, sent scientists to a deserted island for several days and had them solve various everyday problems there. Other Edutainment formats also relied on a manipulation of the everyday world in order to stir interest. Still others focused on the scientific, limiting themselves to an explanation of factual everyday phenomena such as why we sleep etc. Edutainment programmes can thus be further differentiated by whether they use an interesting scientific explanation to connect with the audience's interest, or whether they seek to maximise the interest value by manipulating everyday life and relegating the scientific explanation to the sidelines - which raises the question as to whether they ought to be counted among science programmes at all.

We find indicators that it is mainly the latter type of the so-called Edutainment programmes that reach the highest numbers of young viewers. We further find indicators that

the explanation in itself is not of great importance to explain the popularity of the programmes. The very successful programmes in this group with a share of young viewers of more than 14 percent contain a significantly higher proportion of segments in which the link to science becomes very indistinct. The discussions in focus groups also underline partly that the value of scientific explanations for audiences should not be overestimated, it seems unlikely that edutainment can become an appreciated part of the daily TV diet of consumers.

## References:

- BAUER, M. W. *et al.* (2006), «Long-term trends in the public representation of science across the "Iron Curtain": 1946-1995», *Social Studies of Science*, **36**, (1), 99–131.
- BONNER, F. (2003), *Ordinary Television: Analyzing Popular TV*, Thousand Oaks, London, New Delhi, SAGE.
- BUCCHI, M.; MAZZOLINI, R. G. (2003), «Big science, little news: science coverage in the Italian daily press, 1946-1997», *Public Understanding of Science*, **12**, (1), 7–24.
- COLLINS, H. M. (1987), «Certainty and the Public Understanding of Science - Science on Television», *Social Studies of Science*, **17**, (4), 689–713.
- CUBE, A. V. (1994), «Wissenschaft, unterhaltsam». In: ERLINGER, H. D.; FOLTIN, H.-F. (ed.). *Geschichte des Fernsehens in der Bundesrepublik Deutschland*, Paderborn: Ferdinand Schöningh, 143–158.
- EINSIEDEL, E. F. (1992), «Framing science and technology in the Canadian press», *Public Understanding of Science*, **1**, (1), 89–102.
- FIELD, H.; POWELL, P. (2001), «Public understanding of science versus public understanding of research», *Public Understanding of Science*, **10**, 421–426.
- FRANZEN, J. L. *et al.* (2009), «Complete Primate Skeleton from the Middle Eocene of Messel in Germany: Morphology and Paleobiology», *Plos One*, **4**, (5), e5723.
- GERHARDS, J. (1994), «Politische Öffentlichkeit ein system- und akteurstheoretischer Bestimmungsversuch». In: NEIDHARDT, F. (ed.). *Öffentlichkeit, öffentliche Meinung, soziale Bewegungen*, Opladen: Westdeutscher Verlag, 77–105.
- GÖRKE, A. (1999), *Risikojournalismus und Risikogesellschaft*, Opladen, Westdeutscher Verlag.
- GREGORY, J.; MILLER, S. (1998), *Science in Public: Communication, Culture, and Credibility*, Thousand Oaks, London, New Delhi, SAGE.
- HALLENBERGER, G. (2002), «Das Konzept "Genre": Zur Orientierung von Medienhandeln». In: GENDOLLA, P.; LUDS, P.; ROLOFF, V. (ed.). *Bildschirm – Medien – Theorien*, München: Wilhelm Fink, 83–110.
- HALLER, M. (1999), «Wie wissenschaftlich ist Wissenschaftsjournalismus?: Zum Problem wissenschaftsbezogener Arbeitsmethoden im tagesaktuellen Journalismus». In: GOTTSCHLICH, M.; LANGENBUCHER, W. (ed.). *Publizistik- und Kommunikationswissenschaft. Ein Textbuch zur Einführung*, Wien: Braumüller, 202–217.
- HALLER, M. (2008), «Wie viel Wissenschaft braucht der Wissenschaftsjournalismus?». In: HETTWER, H. *et al.* (ed.). *WissensWelten. Wissenschaftsjournalismus in Theorie und Praxis*, Gütersloh: Bertelsmann, 531–549.
- HIJMANS, E. *et al.* (2003), «Covering scientific research in Dutch newspapers», *Science Communication*, **25**, (2), 153–176.
- KITZINGER, J.; REILLY, J. (1997), «The rise and fall of risk reporting - Media coverage of human genetics research, "False Memory Syndrome" and "Mad Cow Disease"», *European Journal of Communication*, **12**, (3), 319–350.
- KOCH-GOMBERT, D. (2010), «Aufgaben und Strategien der Programmplanung im klassischen Free-TV und im digitalen Wettbewerb». In: LANTZSCH, K.; ALTMEPPEN, K.-D.; WILL, A. (ed.). *Handbuch Unterhaltungsproduktion*, Wiesbaden: VS Verlag für Sozialwissenschaften, 180–194.
- KOHRING, M. (2005), *Wissenschaftsjournalismus Forschungsüberblick und Theorieentwurf. Kommunikationswissenschaft*, Konstanz, UVK.
- LEHMKUHL, M. (2008), «Typologie des Wissenschaftsjournalismus». In: HETTWER, H. *et al.* (ed.). *WissensWelten. Wissenschaftsjournalismus in Theorie und Praxis*, Gütersloh: Bertelsmann, 176–196.
- LEHMKUHL, M. (2009a), «Die Venus und das Embargo», *WPK-Quarterly, Quartalszeitschrift der WPK-Die Wissenschaftsjournalisten*, **7**, (2), 4–7.
- LEHMKUHL, M. (2009b), «"Wir haben den ganzen Job selbst gemacht!"», *WPK-Quarterly, Quartalszeitschrift der WPK-Die Wissenschaftsjournalisten*, **7**, (2), 11–13.
- LEHMKUHL, M. *et al.* (2010), *Science in Audiovisual Media. Production and Perception in Europe: Final report for the European Commission*, Brussels. Download from [http://www.polsoz.fu-berlin.de/en/kommwiss/v/avs/a/Downloads/finalreport\\_avs\\_a\\_2010.pdf](http://www.polsoz.fu-berlin.de/en/kommwiss/v/avs/a/Downloads/finalreport_avs_a_2010.pdf).

- LEHMKUHL, M. *et al.* (2012), «Scheduling science on television: A comparative analysis of the representations of science in 11 European countries», *Public Understanding of Science*, **21**, (8), 1002–1018.
- LEHMKUHL, M. (2012), «Wissenschaft im österreichischen Fernsehen. Zum Zusammenhang von TV-Marktstrukturen und Programmangeboten am Beispiel spezialisierter Formate». In: STEININGER, C.; WOELKE, J. (ed.). *Fernsehen in Österreich 2011/2012*, Konstanz: UVK, 211–228.
- LEHMKUHL, M. (2013), «Wissenschaftsformate im deutschen Fernsehen im internationalen Vergleich. Zum Einfluss der Segmentierung des Marktes auf das Angebot», *Publizistik. Vierteljahreshefte für Kommunikationsforschung*, **58**, (4), 409–426.
- LEHMKUHL, M. *et al.* (2014), «Audience reach of science on television in 10 European countries: An analysis of people-meter data», *Public Understanding of Science*, published online before print 13 June 2014, doi: 10.1177/0963662514536295.
- LEÓN, B. (2006), «Science news as marginal topic. European television channels compared». In: WILLEMS, J.; GÖPFERT, W. (ed.). *Science and the Power of TV*, Amsterdam: VU University Press, 101–113.
- LEÓN, B. (2008), «Science related information in European television: a study of prime-time news», *Public Understanding of Science*, **17**, (4), 443–460.
- LEWENSTEIN, B. (1994), «Science and the Media». In: JASANOFF, S. *et al.* (ed.). *Handbook of Science and Technology Studies*, Thousand Oaks, London, New Delhi: SAGE, 343–360.
- LUBLINSKI, J. (2004), *Wissenschaftsjournalismus im Hörfunk: Redaktionsorganisation und Thematisierungsprozesse*, Konstanz, UVK.
- LUBLINSKI, J. (2008), «dpa und WDR—Redaktionssalltag und Redaktionsforschung». In: Hettwer, H. *et al.* (ed.). *WissensWelten. Wissenschaftsjournalismus in Theorie und Praxis*, Gütersloh: Bertelsmann-Stiftung, 279–296.
- LUBLINSKI, J. (2011), «Structuring the science beat», *Journalism Practice*, **5**, (3), 303–318.
- LUHMANN, N. (1981), *Soziologische Aufklärung 3. Soziale Systeme*, Opladen, Westdeutscher Verlag.
- MÄDER, A. (2009), «Vertauschte Rollen», *WPK-Quarterly, Quartalszeitschrift der WPK-Die Wissenschaftsjournalisten*, (2), 7–9.
- MCQUAIL, D. (2010), *McQuail's Mass Communication Theory*, Los Angeles, London, New Delhi, Singapore, Washington DC, SAGE.
- MERTEN, K. (1973), «Aktualität und Publizität. Zur Kritik der Publizistikwissenschaft», *Publizistik*, **18**, (3), 216–235.
- NIELSEN, K. H. (2009), «In quest of publicity: the science-media partnership of the Galathea Deep Sea Expedition from 1950 to 1952», *Public Understanding of Science*, **18**, (4), 464–480.
- OTT, S. (2004), *Information: Zur Genese und Anwendung eines Begriffs*, Konstanz, UVK.
- PELLECHIA, M. G. (1997), «Trends in science coverage: A content analysis of three US newspapers», *Public Understanding of Science*, **6**, (1), 49–68.
- PETERS, H. P. (1994), «Öffentliche Experten in der öffentlichen Kommunikation über Technik, Umwelt und Risiken». In: NEIDHARDT, F. (ed.). *Öffentlichkeit, Öffentliche Meinung, Soziale Bewegungen*, Opladen: Westdeutscher Verlag, 162–190.
- RÜHL, M. (2002), «Organisatorischer Journalismus. Tendenzen der Redaktionsforschung». In: NEVERLA, I.; GRITTMANN, E.; PATER, M. (ed.). *Grundlagentexte zur Journalistik*, Konstanz: UVK, 303–320.
- SECKO, D. M. *et al.* (2012), «Four models of science journalism», *Journalism Practice*, **7**, (1), 62–80.
- SILVERSTONE, R. (1984), «Narrative Strategies in Television Science - A case-study», *Media Culture & Society*, **6**, (4), 377–410.
- WEBSTER, J. G. (2009), «The Role of Structure in Media Choice». In: HARTMANN, T. (ed.). *Media Choice: A Theoretical and Empirical Overview*, New York: Routledge, Taylor & Francis, 221–233.
- WEBSTER, J. G. (2011), «The Duality of Media: A Structural Theory of Public Attention», *Communication Theory*, **60**, (3), 43–66.
- WEIGOLD, M. F. (2001), «Communicating science - A review of the literature», *Science Communication*, **23**, (2), 164–193.