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Teaching by entertaining

Edutainment in science teaching. A comparative study of educational messages embedded in television programmes.

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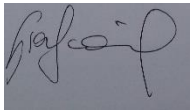|	
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Introduction

"Our world is profoundly shaped by science and technology. Preserving the environment, reducing poverty and improving health; each of these challenges and many more require scientists capable of developing effective and feasible responses – and citizens who can engage in active debate on them." (Tang, 2012:3)

This statement makes it inevitable clear that teaching science is essential in order to ensure development in our world. The aim of teaching is to assist students having an interest in science and developing positive attitudes towards it. The desirable outcome can be defined as individuals engaging in productive science learning (Fitzgerald, 2012:37). However, as societies become more and more reliant on science and technology, there is an upward trend to be frightened to concern oneself with science. As a result, fewer people choose science as a career and as a field of interest (Fensham, 2008:11). In accordance with that statement, UNESCO reports that the number of professionals trained in science and technology is declining (Fensham, 2008:4).

Taking a look at the PISA study conducted in 2012, Austrian teenagers scored an average rate in sciences in comparison to other countries. 15.8 per cent scored inefficient results, while only 7.9 per cent achieved high-performance outcomes (OECD, 2012:3). Students taking part in the PISA study of 2015 acknowledged a general interest in science and that they were aware of the importance science has for their lives. However, only a few participants stated that they were engaging in scientific activities (OECD, 2016:6).

Even though females tend to work less often in the field of science, there is no difference of results concerning gender. Nevertheless, there is a tendency of girls disliking scientific themes, and they therefore show lesser engagement and motivation, as well as lower self-esteem when it comes to their performance (OECD, 2012:6). That is linked to underestimating their capabilities rather than to differences in achievements (OECD, 2016:6). In the course of the twentieth century, a gradual increase of the rights of women has happened. This fight for equal opportunities has also been reflected in education, where girls have to be taken equally serious as learners and be given the same access as boys to all subjects of the curriculum (Wood, 2011:13). Many studies carried out analysed this issue of gender in science education. Girls have been underrepresented in this particular field, which could be because of historical or because of cultural reasons. The problem is that girls seem not to take up or be able to take up science options (UNESCO, 2010:54). Harding (1991:43) argues that the discipline has been shaped exclusively by men and is male-oriented and therefore represents an excluding knowledge.

In addition, educational achievement is still related to social class and prosperity. Historically, education reflected class differences. It has been understood as an access to positions of power and prestige, leading to certain parental attitudes and behaviours. Middle and upper class families have always understood the value of formal schooling, and thus have been sending their children to prestigious schools and universities. Wealthy families have had the opportunity to enrol their children to well-known private schools and into the more influential universities, and consequently enabling them to carry out desired professions. Although there has been made significant progress in relation to widening access, children from lower social classes still remain disadvantaged in the education system (Wood, 2011:12f). The gap between rich and poor is still increasing, leading to the exclusion of certain members of our society from the benefits of scientific knowledge. As a result, these benefits generated by science are unequally distributed between the social classes (UNESCO, 2010:10). However, science – as a means of improving the quality of life – should be available and used by all citizens, regardless of gender or social class. To be usable, scientific advances have to be known and applied (UNESCO, 2010:10)

Furthermore, scientific knowledge should not only be available to children and students of schools. Learning is a process that starts after birth and throughout our lives. The need to learn is fundamental to our humanity. We frequently change jobs, change organisations to which we belong, we change our status and lifestyle. Education thereby is an important agency when it comes to assisting individuals to respond to rapid social change. This change is happening so quickly that it is necessary for people to keep learning. The more technology-based our society is, the easier it is for individuals to become alienated unless they keep learning. Learning, therefore, is an existential process (Jarvis, 2010:12fff.). For effective citizenship, it is important to have more than a casual acquaintance with scientific topics. Science should not be considered an intellectual luxury for the selected few (Hurd, 1958:13).

In relation to unemployment, researchers noted a high correlation between being without a job and lower educational levels. Higher levels of formal education provide a stronger base for employment opportunities because they are specifically linked to current job openings and vocational skills. Education and social class limit the access to work opportunities. This is also linked to having had an education in a field of study that is not directly correlated with the needs of the job market. It is therefore important for adults to have access to formal and non-formal learning experiences (Ross-Gordon et al., 2017:55fff.).

Adult education, however, has been consigned to leisure time and has been priced at such a high fee that few people are able to afford to enrol in classes. When the market makes new demands, it is necessary to acquire new knowledge and skills (Jarvis, 2010:23). Adults, however, choose to not participate in formal educational processes like evening

classes because of a diverse range of constraints that will be evaluated later on (Ross-Gordon et al., 2017:62).

Making scientific benefits known is the purpose of scientific education. There are various distinctive approaches with regard to teaching science at different levels of the educational system. However, the nature of the subject matter itself often leads teachers to choose the "encyclopaedia" point of view and they rather turn to very abstract teaching. As a result, teachers tend to neglect the phase of motivation that is essential to change students' attitudes towards science. The current educational system and its approaches often fail to combine teaching with the practical aspects of everyday life while refusing to use humour as a method, for instance. It is mainly argued that teaching science is to be considered a serious mental and cognitive activity that leaves no space for an emotional point of view. This approach leads to students being distracted and de-motivated to engage in science and therefore blocking their future studies of science. Thus, an overall decrease of popularity and negative attitudes of individuals towards this subject matter can be observed. It is important to look for new methods, forms, and means that might change this tendency. One possibility to accomplish that seems to be the usage of Edutainment (Němec/Trna, 2007:59).

Edutainment, a particular form of entertainment, allows participants to be educated while they entertain themselves. Hence, education takes place without the viewers being aware of it. The teacher does not perform a key role, the information is rather transmitted via new information and communicative technologies, such as the mass media (Němec/Trna, 2007:55). The question that arises is why Edutainment would be considered a better form to educate people about science.

One reason for that is that television has become an important means of informal education in most advanced countries. Most men and women spend their leisure time in front of the TV set, thus absorbing a lot of knowledge and information without having to make a great effort (Chandra/Rajendra, 2004:56). Television is considered one of the main sources of entertainment (Pannu/Tomar, 2010:233). It is the most frequent leisure activity in Austria, too. On average, Austrians tend to spend about 2 hours daily in front of the TV. On weekends, people even watch 2 and a half hours (Statistik Austria, 2010). In 2014, the consumption of television programmes reached a peak value of 172 minutes per day of all Austrians above the age of 12. About 4.6 million of Austrians watch television on a daily basis, which equals 63 per cent of the total population (ORF Medienforschung, 2014). Having a television set has become essential in today's society. We use it to entertain ourselves with sitcoms, and to inform us about current world issues. Television enables us to get every information possible from all corners of the word within seconds. Above that, television plays a vital role in people's development by circulating knowledge in order to

make them more aware and informed. Television provides a forum for a society where issues affecting nation and community life can be aired (Pannu/Tomar, 2010:233). Even though young people today grow up with an immense amount of media products like no other generation before them, television is still the most important medium for young people (Treumann, et al., 2007:77). Especially male teenager watch a lot of TV, 37 per cent watch more than one hour a day. In relation to the school system and social class, "Hauptschüler/innen" tend to watch more TV than "Gymnasiast/innen", with a percentage of 87 that watches TV on a daily basis. Concerning the content watched, series tend to be the most popular programmes on television (79 per cent). Documentaries on the other hand are lesser preferred (Misar-Dietz, 2010:2fff.).

Recognising the importance of television and the reactance towards traditional science teaching, Edutainment strategies seem like the ideal solution to address this issue. In the course of this master's thesis, an investigation will be carried out to analyse if Edutainment has an impact on people's knowledge and attitudes towards science.

Over the past decades, more and more scientific topics have been integrated in television programmes which has led to a richer environment for both adults and children (Tressel, 1988:22). Science and scientists now appear regularly in popular television programmes, films, and other entertainment media. Representations of science in the popular media have, however, rarely been studied in the context of learning. The research base around popular media as a tool for science learning in informal environments is limited, further studies are needed to understand the role of television and film on viewers' knowledge and attitudes (Bell et. al., 2009:257ff.). This thesis shall focus on science-based, adult-oriented Edutainment, or SAE, as Carlson (2012:22) calls it. He further defines it as *"television programming designed to be edutainment and that covers materials of a scientific nature aimed at adult viewers (typically 18 years and older."* (2012:22).
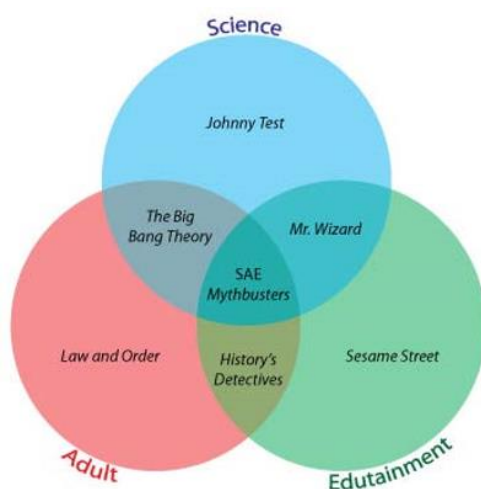
Figure 1 Relations between Edutainment, Adults, and Science (Carlson, 2012:22).

Edutainment, as a mixture of entertainment and education, can take on various forms and formats as will be shown in the course of this thesis. It is therefore interesting to know which type of programme will have the most positive effects on viewers, resulting in helping television producers to understand the influence of their programmes. Especially with regard to class inequalities in education and the finding that lower class members tend to watch more television, it is essential to investigate whether Edutainment may help these viewers to find access to the world of science. This master's thesis will therefore conduct research to find out whether programmes containing both entertainment and education have an influence on their knowledge and attitudes towards science. Additionally, seeing that there is no difference between genders when it comes to results and, nevertheless, less females end up in a scientific career, another focus is laid on the possibility of Edutainment to change girls' attitude and behaviour towards science.

To address these issues, chapter one of this master's thesis will examine the concept of Edutainment in more detail, specifically with regard to its definition, its purpose, and its objectives. Chapter two will then examine the concepts of education and entertainment, as they both form essential characteristics of Edutainment. A special focus will be put on knowledge as an outcome of education. Furthermore, institutions diffusing educational messages will be examined, as well as schooling institutions such as informal distributors like the media. In chapter three, a historical approach of prior executed research on Edutainment is being conducted. Following that, the effectiveness of Edutainment will be evaluated in chapter four, with regard to underlying theories that support those effects, too (chapter five). Chapter six will then contain the research design and an explanation of the methodology used to address the research questions. The results will be presented in chapter seven. This master's thesis will end with a discussion of these results in chapter 8 and an outlook and conclusion in chapter nine.

1. Definition of Edutainment

"Entertainment-Education is the process of purposely designing and implementing a media message both to entertain and educate, in order to increase audience members' knowledge about an educational issue, create favourable attitudes, and change overt behaviour. Entertainment-education seeks to capitalize on the appeal of popular media to show individuals how they can live safer, healthier, and happier lives." (Singhal/Rogers, 1999:9)

Edutainment is a portmanteau word composed of the terms education and entertainment (Reinhardt, 2007:16). As the literature research has shown, there are many expressions to denominate the same concept, like Educational Entertainment (EE) or Entertainment-Education, and even Infotainment. These terms all describe the process of educating the viewers while exposing them to entertainment (Singhal/Rogers, 1999:9). Kalogeras (2014:132) defines Edutainment as a strategy that wants to instruct or socialize its audience by embedding lessons in a familiar form of entertainment: television programmes, computer and video games, films, music, websites, multimedia software, and so on. Walldén/Soronen (2004:2) state that the Edutainment programmes are primarily meant to serve educational purposes.

Wang and Singhal (2009:272f.) note that Edutainment has to be understood as a theory-based communication process where educational and social issues are intentionally integrated in the development and production of an entertainment programme. Education takes place without the participants even noticing it (Němec/Trna, 2007:55). Typically, the structure of Edutainment material on TV includes narrative elements (Walldén/Soronen, 2004:2).

The purpose of this integration is to achieve desired individual, community, institutional, and societal changes among the intended audiences. In this sense, television can be considered as an instrument to cause social change through its educating and entertaining programmes (Singhal/Rogers, 1999:9). Therefore, the ultimate objective of Edutainment is to facilitate a desired behavioural or social change (Govender, 2013:1).

Edutainment is not intended to be a communication theory, but rather it has to be comprehended as a communication strategy that wants to constitute positive change or discussions on certain issues (Singhal/Rogers, 2004:5). It can influence members' awareness, attitudes, and behaviours towards a socially desired outcome. The anticipated effects, on the one hand, are triggered within the individual audience member itself. On the other hand, they can influence the external environment in the sense of creating the necessary conditions allowing social change to happen. Therefore, these effects concern the interpersonal, as well as the social-political sphere of the audience's environment (Singhal/Rogers, 1999:9).

Edutainment and its ability to translate key development and social problems to audiences rely on the use of media. The messages have to be embedded in programmes that are engaging, entertaining, and receptive. Adopted in a television format, Edutainment is a catalyst for discussion (Govender, 2013:2). The educational purpose can be related to either the formal education of different school institutes or to informal learning that happens in the context of everyday life (Walldén/Soronen, 2004:4). There are even school lessons that implement Edutainment as a basis for teaching in a more efficient and faster way (Kalogeras, 2014:132).

Carlson (2012:21) understands Edutainment as *"rhetorical strategies that use entertainment tactics designed to help consumers understand, retain, or apply a given subject matter."* For that, he defined the following parameters with regard to Edutainment about science:

- The programme is originally produced for television. It has to employ entertaining elements as a means to support education.
- Although shows are produced to make profit, their commercial appeal is the educational component
- The shows have to convey extrinsic knowledge. They must inform on facts which would be true or useful regardless of the Edutainment product
- The show conveys new understanding to the audience and not merely employ the use of information in entertainment

(Carlson, 2012:21).

The unequal global availability of information technology has enabled a digital divide. As knowledge is accumulating by its nature, the rapid technological development has even led to a faster and faster accumulation of knowledge. This even worsens the inequality with regard to the distribution of information and knowledge. Edutainment can decrease this problem because it is easier to approach Edutainment programmes than more traditional learning material (Walldén/Soronen, 2004:4).

After having established what Edutainment actually is, the next chapter will look at its characteristics in more detail.

2. Characteristics of Edutainment

As mentioned in the previous chapter, Edutainment involves the processes of entertaining and educating (Singhal/Rogers, 1999:9). Looking at this definition, it is important to specify the terms of education and entertainment respectively to establish characteristics and to understand the concept of Edutainment in a broader way.

2.1. Education

"Learning is central to human life." (Foley, 2004:4)

Education contributes to the common good by enhancing national prosperity, and supporting stable families, neighbourhoods, and communities. People can meet future challenges in terms of economic, environmental, and social changes if they have the opportunity to prepare for them. Hence, the aim of education is to develop transferable knowledge and skills (Pellegrino/Hilton, 2012:1-1).

2.1.1. Definition of education

The word education derives from the Latin word "educatum" which means becoming developed from the inside to the outside, while undergoing a process of creating inner abilities (Chandra/Rajendra, 2004:1). Wood (2011:XIIf.) states that education refers to the process of acquiring or imparting skills, as well as the development of the ability to reason and to think critically. It is strongly linked with the concept of learning, and, consequently, with the concept of schooling. Pupils and students attend schools, colleges, universities, and other institutions in order to get educated. Contemplations about systems of schooling has led to many different forms, some more formal, some more dependent on people's direct experience of their environment (Wood, 2011:XII).

In general terms, education is a process of development. The steps of this development begin at home. The teachers' task is to continue and facilitate this process by encouraging children to learn. Moreover, the process of education continues right through an individual's life time (Chandra/Rajendra, 2004:3).

Walldén/Soronen (2004:6) divide the process of acquiring information into cognitive (knowledge), affective (emotions), and psycho-motor (skills) learning. An individual has to gain the following elements in the process of his or her development:

- Knowledge of the surrounding environment
- The necessary motor control skills to fulfil individual needs
- Linguistic abilities to enable conversation
- Knowledge of individual and collective relationships
  (Chandra/Rajendra, 2004:2f.)

Therefore, we will now take a look at knowledge as an essential part of education in more detail.

2.1.2. Knowledge

The process of acquiring and retaining knowledge in the memory is called learning. It is the total value of all the experiences of an individual from the beginning of its life. In general terms, learning has been defined as the relatively permanent modification of someone's behaviour that is carried out during practical actions. One can have considerable knowledge as a result of learning, however, it stays useless until it is activated to perform a task, make a decision, solve a problem, or understand an issue. Therefore, knowledge must not only be acquired, but also retained and remembered in order to be useful to a person over a longer period of time. If knowledge is gained but does not influence behaviour and cannot be retrieved from memory, the educational process has failed. To measure whether a person knows something, it is important to compose test items that represent the topic in a fair and unbiased way. Knowledge cannot be observed directly. Hence, performances on a test have to be measured. Questions have to be designed in order to determine the beliefs of a person regarding a certain issue. If these beliefs about objects, people, processes, and events prove to be correct, they can be accounted for knowledge. These beliefs must not only be correct, they also have to be justified. However, the question about exactly what evidence is necessary and sufficient to allow a correct belief to be justified has been a topic of discussion for a long time now (Hunt, 2003:101fff.).

Furthermore, it is not only important for students to learn about a subject, it is also necessary to develop deep interest in the content. Being able to understand or get a high score on an exam is not the only purpose of schooling (Foster, 2008:600).

2.1.3. Schooling institutions

In summary, the purpose of education is to transfer knowledge. This process generally takes place in schooling institutions. In these institutions, the idea of education is linked

with a predetermined curriculum, exams and formal tests, ending generally with certificates. A methodical approach to a body of knowledge is chosen, which is supported by relevant experts and then delivered to both willing and unwilling learners (Wood, 2011:1). Trained and professional educators transmit this knowledge at a fixed time and place, according to a predetermined syllabus. Different schools are intended for different kinds and levels of education, for example: primary, secondary and higher education, university education, adult education, and so on. The function of these schools is to achieve physical, mental, and character development of students, in order to build up a social consciousness that is necessary for citizenship (Chandra/Rajendra, 2004:51).

Such agencies of education are brought into existence by the state or society. In such institutions, discipline and administration are generated by the application of a set of rules. It is possible to use these agencies to provide education to a large number of citizens simultaneously. However, education delivered through the school system is rather lifeless and theoretical, or even bookish one might say. It sometimes takes the students far away from the realities of life itself (Chandra/Rajendra, 2004:50). Moreover, the curriculum in schools has in many respects remained unchanged since formal education began (Wood, 2011:XII).

In addition, society is changing so rapidly that many of the traditional educative organisations are not able to keep up with the new demands it is presenting. Therefore, individuals are basically forced to learn outside of the education system (Jarvis, 2010:31).

2.1.4. Aspects of education

It is important to acknowledge that education can be both formal and informal. Formal education includes education as it is provided in educational institutions according to a particular pattern, as was explained before (Chandra/Rajendra, 2004:6). It results in recognised diploma and qualifications and is concerned with structure-based learning (Walldén/Soronen, 2004:6).

Non-formal learning, on the other and, takes place alongside the official system of education and does not typically lead to formalised certificates. It may be provided in the workplace or through activities of civil society organisations. Informal learning describes a lifelong process whereby individuals acquire attitudes, values, skills, and knowledge from daily experiences, educative influences and resources in their environment (Walldén/Soronen, 2004:6). Informal education does not depend on a specific time or place at which it is provided. It is received while playing, talking to family members, roaming around somewhere, in fact, everywhere. This kind of education never comes to an end and it actually

teaches the individual more than she or he can ever learn via his formal education (Chandra/Rajendra, 2004:6f.). Accidental learning happens when in everyday activities, an individual learns something that he/she has not intended nor expected (Walldén/Soronen, 2004:6).

Another distinction is made between direct and indirect education. The teacher and students can be in direct contact when information on a specific subject is being transmitted. However, education does not need to rely on this direct form of contact. Indirect education is very important as the population is growing and life becomes more and more complex. Modern developments such as the printing press, radio, television, etc. have made it possible to communicate ideas to large parts of society. Hence, indirect education has come to be of greater significance than direct education. During the last few years, teaching through the medium of radio or television has become more popular and reaching a higher level of sophistication (Chandra/Rajendra, 2004:7f.).

When conscious education takes place, the students are fully aware of the learning process. This kind of education is a conscious act of achieving certain predetermined objectives. Unconscious education, however, is given by the natural and social environment that surrounds the individual. This kind of education is informal. Learning, here, is mostly an unconscious act of development (Chandra/Rajendra, 2004:9).

Casual learning implies that the teacher (producer of the content) creates and provides the content along with alternatives (or economic competitors) and learners select from these and utilise this material at their leisure. The content of casual learning opportunities is not controlled by accrediting bodies, nor regulated by the government or respective institutions. The choices learners make in selecting their learning material are incredibly important (Carlson, 2012:114).

2.1.5. Adult education

Adult education has become more and more important as society and education has changed over the years. Technical or vocational education has expanded and is more diversified now. Numerous fields of practice have generated their own distinctive forms of education. Human resource development is now concerned with issues of workplace learning and change (Foley, 2004:3).

Adult education consists of formal education, non-formal education, informal learning and incidental learning, too. It is organised by professional educators and takes place in educational institutions such as universities as well as technical and further education colleges, and sequenced training sessions in workplaces. Non-formal education occurs when

adults see a need for some sort of systematic instruction, but rather in a sporadic way. For example, workers are being trained to operate a new machine or the like. Informal training does not involve formal instruction. Adults rather take part in individual or group reflection and discussion to try to learn from their experience. For example, the management committee of a community centre reviews the operations of its organisation. Incidental learning occurs when adults perform other daily life activities (Foley, 2004:4f.).

Especially unemployed people profit from adult education. Adult learning during unemployment positively affects individuals' chances of re-entering the labour market. Taking part in formal adult education, tertiary education, or vocational upper secondary schooling significantly improves unemployed persons' chances of becoming employed (Wahler et al., 2014:235). One preventative und curative task to fight unemployment is, therefore, to create new qualifications within a short period of time, i.e. to offer further education and training (Rohrer/Sgier, 1997:140). For example, part-time evening classes play an important role in correcting and rectifying mistakes made in initial schooling. Adult schools are essential in directly combating unemployment, by paving the way for higher qualifications and laying the foundations for vocational training and re-entry to the labour market (Harangi/Tóth, 1997:65).

For adult learners, approaching a new subject requires the insight, to varying degrees, that they might not have immediate access to entire bodies of knowledge (Carlson, 2012:116). They may have external and internal obstacles to overcome when it comes to learning (Walldén/Soronen, 2004:47). Desjardins/Rubenson (2013:263) identified individual and structural types of constraints that keep adults from participating in (formal) educational processes. Individual constraints are due to dispositional factors, liquidity and informational factors. Structural constraints include the factors family, job, institutions, liquidity and informational variables. Dispositional factors are related to an individual's abilities to be intentional in selecting and acting upon adult learning opportunities. They choose to utilize external resources such as financial and social support or internal resources such as key talents, attitudes, beliefs and competencies like self-efficacy and self-esteem to pursue learning needs and goals. In this sense, they may be afraid of being too old to learn, or of participating in learning processes in general. Furthermore, they may have a limited sense of self-esteem. In addition, they may not have the financial resources to participate in formal education or may lack access to informational resources (Desjardins/Rubenson, 2013:263). Internal obstacles include cognitive and psychological (attitudes, self-confidence) reasons (Walldén/Soronen, 2004:48).

Structural constraints also affect the decision on the participation of adult learners. For example, they may not have travel opportunities to reach an educational institution or are

being held back by inexpensive child care. Another example would be the lack of a computer (Desjardins/Rubenson, 2013:264). Walldén/Soronen (2004:48) also identified social conditions (work, family) and other leisure time activities (hobbies, friends).

In summary, adults have possibilities to learn, however, formal education is more difficult for them than for younger people who are provided with the opportunities of schooling institutions. For that reason, informal and incidental education can be used to educate adults in a better manner.

2.1.6. Informal agencies of education

Speaking of informal, indirect, and unconscious education, informal agencies in contrast to schooling institutions have to be mentioned. One characteristic of them is that they provide education indirectly and the knowledge transmitted is picked up unconsciously. These agencies lack all formality, rules, systematisation, preplanning, premeditation, or training. Most of them are independent of the control of any individual or institution. Among these agencies of informal education are the institutions of the family, society, state, radio, press, cinema, magazines, television, etc. Even though the influence of these informal agencies is subtle, it is definitely very comprehensive. The major benefit derived from them is that they do not restrict the learner in any way. Despite this advantage, informal agencies cannot replace the formal ones completely, as they cannot be employed to give specific education or knowledge of a very complex kind alone. Both informal and formal agencies of education are essential for the development of an individual and society. Consequently, there is an intimate relationship between formal and informal means and agencies of education. When formal education increases to a great extent, it tends towards abstraction and lifelessness of the subject matter and then it needs the assistance of informal agencies to infuse new life into it (Chandra/Rajendra, 2004:50f).

Another advantage of informal education is that it is closely connected to the actual life of a learner. However, it is difficult to control possible misunderstandings or mobilise the transference of learned material to actual practices (Walldén/Soronen 2004:2).

As mentioned above, television has become an important means of informal education in most advanced countries. Most men and women spend their leisure time in front of the television, and thus absorb a lot of knowledge and information without having to make a great effort (Chandra/Rajendra, 2004:56). Education transmitted via television is an example for informal education, as it takes place outside of schools and could involve experiences that are not part of a school curriculum. These programmes must compete with other leisure activities to gain people's attention (Tressel, 1988:22).

In order to get their attention, television programmes, and especially educational television, need to be highly appealing. Other than that, the programme has to be designed to fit the requirements of informal education. The educational content cannot depend on being presented in a particular sequence over a period of time. Building on previous lessons for tackling more complex concepts is not possible on television, because there is no guarantee that the episodes will be broadcasted in the right order or that people will actually see every episode. There is no teacher present who can mediate the learning experience. Moreover, programmes reach viewers in an informal setting, at home for instance, where the space is not explicitly organised for learning (Singer/Singer, 2012:530).

Educational television is not at all intended to replace formal education in school. Rather, it is intended to supplement formal education. This way, viewers are exposed to topics that they might not encounter otherwise. Furthermore, they provide compelling experiences that allure audiences into spending additional time exploring various topics already covered in formal educational processes and they encourage positive attitudes towards (academic) subjects. In addition, these programmes motivate people to engage actively in learning both in and outside the classroom (Fisch, 2014:10).

In order for a TV programme to get the viewers' attention, entertainment plays a key role. For that reason, the next subchapter will explore entertainment and its definition, characteristics, effects and its connection to television more closely.

2.2. Entertainment

What exactly is entertainment? First of all, it can be found in a nation's airwaves, popular magazines, or newspapers, and it is considered the most pervasive mass media subgenre. It influences people in how to dress, speak, think, and behave (Piotrow, 1990:13f.). Generally speaking, entertainment is easily located, accessed, and consumed. It is furthermore described to be attractive, stimulating, sensory, and emotional to a mass audience (Shay/King, 2010:4). Understand entertainment in more definite terms, Walldén/Soronen (2004:6) argue that it is not possible to define entertainment because to be entertained is always a subjective experience. Nevertheless, it is necessary to define entertainment in order to fully understand the concept of Edutainment.

2.2.1. Definition of entertainment

The word entertainment derives from Latin and means "to hold the attention of", or "agreeably diverting". Nowadays, it refers to a constructed product which comes into existence

to stimulate a mass audience in an exchange for money (Shay/King, 2010:4). Entertainment is defined by the Oxford English Dictionary as *"the action of providing or being provided with amusement or enjoyment"*, and enjoyment is further defined as *"the state or process of taking pleasure in something"* (Gray, 2008:3).

Mayer (2014:36) also argues that a definition of entertainment is quite difficult to establish and to measure, as so many emotions – from joy to fear – can be indicators. Zillmann/Bryant (1994:448) define it similarly as *"any activity designed to delight and, to a smaller degree, enlighten through the exhibition of the fortunes or misfortunes of others, but also through the display of special skills by others and/or self"*. Whitey/Abeles (2013:329) further understand entertainment as an activity that is associated with terms like amusement, art, diversion, enjoyment, escapism, fun, gratification, pleasure, recreation, etc. Another definition provide Singhal and Rogers (2002:117), who declared entertainment as a performance or spectacle that captures the interest or attention of individuals, supplying them with pleasure and amusement. It can therefore be stated that pleasure and amusement are important components of entertainment and, in this sense, it is a very important form of culture for the majority of citizens in Western countries (McKee, 2012:9).

The literature research shows that entertainment is quite often defined as the contrast of high culture as it forms part of popular culture (McKee, 2012:9). Foltin (2002:2406) stresses, however, that entertainment should not be considered a counterpart to information. For a very long time, entertainment has had to deal with this negative connotation of being an opponent to culture and had to endure various critiques. Only recent media research is considering a more unprejudiced approach to entertainment where it is understood as a process that ends typically with a reaction from a recipient. This process involves said recipient and also a transmitter who engage in an act of communication on equal footing (Foltin, 2002:2406).

To better understand this process, it shall be further elaborated what the specific characteristics of entertainment are.

2.2.2. Characteristics of entertainment

First of all, it can be stated that entertainment has remained remarkably consistent over the past one hundred and fifty years (McKee, 2012:10). Generally speaking, entertainment refers to the style of a programme where content is provided using characteristics and means of certain genres, like a sitcom, for example (Walldén/Soronen, 2004:7). To define these consistent characteristics of entertainment, Matthews (2008:2) suggests to look at its three components: form, reason, and content.

2.2.2.1. Forms of entertainment

When talking about the form of entertainment, one has to look at the origin of performance. The beginning of human performance cannot be traced back scientifically, however, archaeological evidence suggests that certain genres of performance took place. Humans then were capable of using two basic forms of communication: vocalisation and physical movement. At some point in the unrecorded distant past, these basic communication skills further developed into the emergence of entertainment as in singing, storytelling, dance, and athletics (Matthews, 2008:2ff).

Due to a process of industrialisation and urbanisation in the nineteenth century, entertainment evolved into its current form (Levine, 1988, in: McKee, 2012:10). Especially the emergence of mass-produced culture led to distinct textual features and therefore to many new forms of entertainment (Ohmann, 1996, in: McKee, 2012:10).

Today, entertainment may exist as a product, service, or experience. For instance, entertainment as a product may be tickets to live performances. Companies occupied with television and movie production create entertainment as a product, too. Entertainment as a service is provided, for instance, by travel industries, venues and hospitality industries that offer attractions, activities, sport events, and so on. These services want to please consumers. What differentiates entertainment from other products and services is its experiential component. Entertainment is always an experience that only lasts as long as the consumers participate or watch. It can be a live or mediated experience which means that entertainment is also intangible. It is an experience that diminishes as time passes and it cannot be "taken home". Even when we buy a book, the experience of reading is still a mental activity and its pleasure lies in its verbal consumption at a certain time. The value of an experience relies on the consumers' willingness to pay for it (Shay/King, 2010:4f.).

Entertainment can also be distinguished according to genres and subgenres. Music for example can be considered a primary entertainment genre with subgenres of vocal and instrumental music. Theatre consists of the subgenres of comedy, tragedy, and general speech. Dance, for instance, consists of the subgenres of cultural dances (e.g. folk, ethnic, traditional), ballet, and modern or contemporary forms. Athletic entertainment comprises all other physical entertainment as sports and activities of acrobats, jugglers, magicians, stunt people, and stilt walkers. The genre technology includes the use of mobile devices, sophisticated lighting, touchscreens, and visual presentation technology (Matthews, 2008:2ff.).

The form of entertainment can also be distinguished according to non-performative classifications. The size refers to group performances of small and large scales or solo performances. A specific use of props such as stilts, mobile devices, lighting, lasers, or music

serves also as a classification. These genres, subgenres, and characteristics can be combined with each other to create a specific form of entertainment (Matthews, 2008:4).

2.2.2.2. Reasons for entertainment

Entertainment is always constructed, designed with a conscious purpose (Shay/King, 2010:4f.). First and foremost, entertainment products are created to generate pleasure. They aim for attracting, growing, and maintaining audiences and therefore they must cause agreeable effects for them (Shay/King, 2010:6). The performed acts have to satisfy the audience's needs and deliver the results promised based on the reason for entertainment (Matthews, 2008:5). However, entertainment is still a capitalistic product and developed to make a profit (Shay/King, 2010:6). Besides this financial aspect, entertainment can be designed to fulfil various goals.

According to Matthews (2008:6), one reason for entertainment is to impart knowledge to an audience. It may also aim at moving people physically, as it is the case with sports or music performances. Besides the physical aspect, entertainment may want to move people emotionally. An emotion is considered a response to a stimuli that involves physiological changes, such as an increased heart rate for example. The primary emotions are fear, anger, sadness, joy, surprise, disgust, and contempt. Emotions usually motivate individuals towards further activity. This motivational aspect is another potential goal of entertainment. As opposed to only trying to stir inner feelings, motivation leads to actually taking action by adding a specific message to a performance. Furthermore, entertainment can also be used as decoration. The performers themselves can take on the persona of decorations as dancers for instance that are placed among tables at an event space. Decorative entertainment can be stationary or moving, interactive or active (Matthews, 2008:7). Entertainment may also be used for advertising purposes as it can announce and introduce people, products, services, or activities. For instance, celebrities can be the masters of ceremonies or fireworks introduce the New Year (Matthews, 2008:8). Entertainment may serve the purpose of creating an ambience, like static décor or lighting, but also adds other sensory inputs that help to set a mood. Not all entertainment forms need to have a deeper reason, sometimes the purpose is only for image purposes as in gaining prestige (Matthews, 2008:9).

2.2.2.3. Contents in entertainment

Matthews (2008:10) elaborates further that analysing the content helps to define entertainment's characteristics. The performance must deliver the expected content to an audience. McKee (2012:10) suggests to examine the content in terms of vulgarity, story, seriality,

adaption, happy ending, interactivity, speed & volume, spectacle, emotional response, and fun.

According to McKee (2012:10f.), entertainment content is vulgar as it relates to the common people. It also lacks in knowledge and is often sexualized (Nasaw, 1993:106, in: McKee, 2012:11). When looking at content, one inevitably has to turn to the element of story. *"The term 'story' means a series of events in a cause and effect order linked by characters driven by plausible psychologies."* (McKee, 2012:12) A story is absolutely necessary in order for entertainment to function. This does not only apply to media like newspapers, magazines, films, and television, but also for pop songs, popular dance, and music events. A key criteria of entertainment is that everything must serve the story, from lighting to camerawork, and costume design to visual effects. Furthermore, the story is characterised by its seriality which is achieved through the usage of the same characters, similar situations, and similar story structures. This applies likewise to a single story that is serialised across a number of episodes, linked by cliff-hangers, or a series of self-contained stories in the same diegetic world. The value of a content is based on its ability to revisit the same settings while finding new angles, ideas, and new stories to tell (McKee, 2012:12f.).

Another entertainment characteristic is the adaption of a content. Here, characters or stories are taken from one medium and transferred to another one. For instance, a novel can be moved to the stage. This process has been a long-standing tradition in the entertainment industry. With every emergence of a new entertainment medium, content was taken from already existing entertainment forms (McKee, 2012:13).

McKee (2010:14) also suggests to look at happy endings when contemplating about the content, as they have been a central part of entertainment throughout its longstanding history. This does not necessarily mean that a story always has to end in good terms, it rather concentrates on a satisfying resolution. The story must feel completed and all the arisen questions have to be answered by the end. Entertainment rarely leaves key mysteries for the audience to work out. Even if there is a sad ending, the audience takes some positive values out of it – like hope or friendship for example (McKee, 2012:14).

Another key factor is interactivity. Based on its content, audiences are expected to interact in different ways. At the opera, viewers must sit in respectful silence, while at a metal concert, they are expected to scream and dance. Entertainment does not work without interaction as it only becomes entertainment when it entertains an audience (McKee, 2012:14f.).

In terms of speed, McKee (2012:15) mentions the short attention span of an audience or rather its fast information processing ability that needs content to be speed-driven. Entertainment can further be evaluated according to its volume. Loudness is cherished in night

clubs or at rock concerts, but silence and contemplation may also be valued, in cinemas for example (McKee, 2012:15).

Visual pleasure is another key element of entertainment. Even written entertainment forms demand visual spectacle, even if it is just generated in someone's mind. For example, attractive men and women often show their bodies for visual pleasure (McKee, 2012:15f.).

As already mentioned, generating emotions can be the purpose of entertainment. The content can therefore promote an emotional reaction in the audience (McKee, 2012:16).

Last but not least, fun is another key entertainment virtue and an intrinsic good. Entertainment does not need to have any other purpose as to create enjoyment as an end in itself (McKee, 2012:17).

Looking at all these elements of entertainment, it is interesting to know which effects entertainment can generate.

2.2.3. Effects of entertainment

In general, entertainment may elicit strong emotions, it may teach participants something they do not know yet, and it can help them to escape from real life experiences into simulated or vicarious adventures (Shay/King, 2010:6). The most obvious intended effect of entertainment, as already mentioned, is entertainment itself. Audiences expose themselves to these experiences with the unsurprisingly intention of being entertained (Shay/King, 2010:110).

However, entertainment also creates a variety of other effects besides this primary intent, both intentional and unintentional. Audiences themselves seek a number of other gratifications, including distraction from problems and information about societal norms (Shay/King, 2010:110).

When someone is exposed to entertainment, an individual escapes for a short span of time from his or her world, leaves his everyday life behind and enters into a new dimension with other rules and norms. They eventually return to their original surrounding when the exposure comes to an end or his/her need for escapism is satisfied (Foltin, 2002:2406).

Besides effects pursued by the audience, ramifications can be generated by external factors. A corporate sponsor of a sporting event hopes that the event will not only entertain audiences but also captures their attention and ultimately results in an increase in sales of their products. And many books, films, or songs are created not only to entertain but also to educate and persuade audiences about specific issues that are important to the producer (Shay/King, 2010:110). It can therefore be stated that entertainment does not only

exist for our amusement, but it is a medium where social issues are presented and negotiated (Klein, 2011:905). It is important to notice here that we can be educated by the entertainment media, even if this is not the main aim of the source and even if the audience is unconscious of that procedure.

Entertainment may also have unintentional side effects. If entertainment can intentionally affect our emotions, thoughts, and physical reactions, some argue that these effects may also unintentionally influence our more general feelings, thoughts, behaviours, and physical well-being. Media like books, movies, music, and video games have often be accused of initiating negative side effects such as encouraging violence, drug use, or racial stereotyping. However, they have also been credited with some positive impacts such as relieving stress, increasing awareness of social issues, improving physical health, and educating children. Research finds that some forms of entertainment work better for some audiences than others (Shay/King, 2010:110f.).

Looking at all these effects, it can be argued that culture itself is communicated through entertainment. Entertainment can shape an entire culture, through more superficial trends like clothing or through more serious transactions, like the accusation of the "americanisation" of the world (Shay/King, 2010:4).

The need for entertainment depends on many different factors, as it naturally changes over time. The main point is, however, the positive stimulation, that needs to happen because of boredom as well as frustration that result from failures of the actual reality. Entertainment can be considered as escapism in a negative sense, but also positively as a necessary act of mental hygiene that revives the individual to face life again (Foltin, 2002:2407).

Piotrow (1994:4f.) gives a valuable summary of characteristics and effects by stating that entertainment is perennial, pervasive, popular, personal, pleasurable, persuasive, passionate, profitable, and practical. It is perennial because entertainment media have existed for a long time and are expanding to every country on this planet. Entertainment is popular, as it is appreciated and wanted by various cultures to be entertained. Furthermore, content is presented in a personal way through characters and narratives. Entertainment is pleasurable, it provides release or escape. It also can be persuasive as in encouraging audiences to adopt pro-social attitudes and behaviours, such as following healthier lifestyles or reducing relationship conflicts. It also attempts people to control various types of stress. Entertainment programmes are passionate, as they can stir strong emotions about a social or educational issue. Media that makes successful use of entertainment usually earn high audience ratings and are therefore profitable. They are also practical, as they are attractive to commercial sponsors.

To sum it up, entertainment can be characterised by its form, reason, and content and can generate various effects for audiences and for their surroundings. In a next step, it will be elaborated how the concept of entertainment works in the medium of television.

2.2.4. Entertainment and television

Most entertainment products rely on technology to maximize their effectiveness (Shay/King, 2010:6). With the beginning of the dual system of public and private stations in Europe, entertainment forced its way into the television. Private stations have been focusing on the recipient's need for entertainment ever since, as their success depends heavily on viewing figures. As a consequence, public stations had to adapt to fit the conditions of the market. The main aim of television stations is getting as many people as possible to watch (Klöppel, 2008:124).

According to the Austrian law concerning broadcasting ("Rundfunkgesetz"), the national public broadcasting service ORF has to comply a programming mandate. In addition to the protection of basic rights and other important issues, the ORF has the task to inform the Austrian people. Abiding the principles of objectivity, impartiality, and diversity of opinion, the institution has to make a constructive contribution to the societal formation of opinion according to the democratic principles. Furthermore, the ORF has to impart learning opportunities, ranging from general guidance to scientific findings and presenting new technologies. It is the task of the ORF, therefore, to act as a service programme to ensure education and information. As the ORF is a mass medium, it still has to attract a lot of viewers. As a consequence, entertainment is part of the programming mandate. It states that the audience seeks relaxation and stimulation, which has to be considered in the planning of the programme. It also acknowledges the fact that entertainment has a major influence on the audience. Entertainment can influence behaviour, self-conception, and identity like no other sector (ORF, 2005).

Nowadays, television might be the greatest draw on our time. It is not just a technical device in our living room but rather a leisure activity that occupies a great deal of our everyday routines and approaches almost all aspects of our lives. Statistical research suggests that when we are watching TV, entertainment programmes are the most popular ones. Although many viewers agree that watching the news is especially important, and that a documentary is supporting educational aims in a great manner, they still watch entertainment programming in huge numbers (Gray, 2008:2). With regard to these different kind of programmes, the following distinction can be made according to their primary aim, like to entertain, to inform, and to educate:

- entertainment programmes
- news, documentaries, and educational programming
- advertisements (Gray, 2008:3)

However, this distinction is not always as clear as it seems. Advertisers frequently hope to entertain or sell their products by informing and educating watchers. The news is increasingly becoming entertainment-driven. And finally, educational programming is entertaining and entertainment often informs and educates (Gray, 2008:3f.), as it is the case with Edutainment.

Television entertainment in particular has an influence on the words we speak in our everyday life, the things we argue over and think about during the day (Gray, 2008:2f.). However, this mediated activity now primarily takes place at home. Entertainment audiences withdrew from public venues into private spaces with the result that not only the nature of entertainment has changed but also the way of living life. Especially the arrival of electronic mass media shifted entertainment from an activity of participation to an activity of visual spectacle. Because of cable and satellite broadcasting, viewers are able to choose from a wide range of programming to fit every taste and preference (Shay/King, 2010:13).

With the emergence of the Internet, users have been able to go online for entertainment and education (Shay/King, 2010:13). Now, the television entertainment experience is not confined to one medium or delivery system anymore. Instead, recipients have portable electronic devices that allow them to enjoy entertainment everywhere they go. The term convergence plays an important part here, as it describes a phenomenon involving the interlocking of computing and information technology companies, telecommunication networks, and content providers from the publishing worlds of newspapers, magazines, music, radio, TV, movies, and entertainment software (Shay/King, 2010:22). Convergence does not only describe the intermixture of content creation, but also of distribution, and consumption. It is the merging of entertainment, advertising, and technology. This dynamic processes are transforming the way in which media, music, and advertising industries merge in order to reach their markets (Shay/King, 2010:13).

Convergence is to be understood as a process rather than an endpoint, which is defined by changing consumer flows through the media landscape and changing relationships between existing technologies, industries, markets, genres, and audiences (Shay/King, 2010:22).

Young people today grow up with an immense amount of media products like no other generation before them. This has to do with the rapid development of media products during the last decade. Moreover, we can see an increasing complexity with a simultane-

ous segmentation of these products. However, despite the huge amount of leisure activities and media products, television is still the most important medium for young people (Treumann, et al., 2007:77).

With all these possibilities of being entertained, consumers also have more choices than ever. However, time and money are limited. Attention is a scarce resource and therefore the most sought-after commodity of entertainment producers. Marketers especially want the consumers' money and try therefore to catch their attention. Attention consists of two types of values: instrumental and terminal. The instrumental value refers to the fact that attention can lead to other wanted actions. To facilitate these actions, persuasion is applied where attention is always the first step (Shay/King, 2010:16). Attention also has a terminal value, meaning that many people value it for its own sake. People value both the attention we give and the attention we receive (Shay/King, 2010:16). If something is boring, we do not pay attention to it. Entertainment has the quality of capturing attention. If you do not hold the interest of an audience, as in if you do not entertain them, they will stop paying attention to it (Shay/King, 2010:16).

Furthermore, television programming is a powerful tool when it comes to educating. Complex cognitive tasks are more easily achieved when they are supported by emotional elements. These emotional elements can be generated by telling stories through pictures. The level of episodic learning while viewing programmes is potentially high. Cognitive transfer is even possible without having to revisit the same material at different times. Finally, television is an accessible medium for most people, which means that opportunities for learning are provided to large audiences of different cultures on a frequent basis (Dhingra, 2003:235).

A study conducted in 2012 in the United States showed that American audiences receive information about science and technology primarily via the television (34 %) and the internet (35 %) (Dahlstrom, 2014:13615). If educators want to promote lifelong learning, they need to target people when they are doing what they prefer doing in their leisure time (Whittle, 2012:10).

In summary, entertainment represents a practical way of carrying educational-development messages (Brown/Singhal, 1999:265) as it captures viewers' attention. After exploring the meaning and characteristics of Edutainment in all of its facets, the next chapter of this masters' thesis will examine in which way these educational-development messages have been embedded in entertainment throughout the history.

3. History of Edutainment

The idea of embedding an educational message in an entertainment product is not an entirely new concept. Throughout human history, storytelling has been used to educate people while entertaining them. Folktales with embedded moralities for instance have always been a part of a child's informal education (Singhal/Rogers, 1999:12ff.). During the era of Renaissance and Enlightenment, plays and other educational methods gained importance in educating the population (Němec/Trna, 2007:55).

However, Edutainment itself is a relatively new invention as its formation depended on the emergence of mass media (Singhal/Rogers, 1999:12ff.). Since then, the concept of Edutainment has been integrated into television, radio, and popular music, addressing various issues like health and family planning for instance (Govender, 2013:1).

In radio, the first embedded educational strategy dates back to 1951, when the British Broadcasting Corporation (BBC) aired "The Archers", a radio soap opera about the life of a fictitious farming family involving educational messages about agriculture (Singhal/Rogers, 1999:14). In 1969, the first television soap opera, "Simplemente María", employed an Edutainment strategy to educate its viewers. Its main character María was facing problems and tragedies, wherefore she moved to the capital city to start a new life. She worked hard in order to achieve her goals, displaying strong motivation and upward mobility. Her successful engagement led many working class women in Latin America to enrol in literacy and sewing classes as the character did in the telenovela (Singhal/Rogers, 1999:14).

Impressed by the success of "Simplemente María", Mexican producer Miguel Sabido began to occupy himself with the idea of Edutainment. He developed a methodology for entertainment-education strategies and produced, as a result, seven soap operas that were both educational and entertaining. Moreover, they were commercial hits. Important achievements of his Edutainment telenovelas were that many viewers enrolled in adult literacy classes and integrated the concept of family planning and gender equality into their lives (Singhal/Rogers, 1999:14). Sabido's strategy is dominant in most Edutainment projects all over the world and will be examined in more detail later on in this master's thesis. It was then realised that the aim of Edutainment programmes is to reinforce specific values, attitudes, and behaviours without having to sacrifice commercial appeal. Thus, Edutainment messages were designed in order to fortify the educational development of viewers. Based on communication and behavioural theories, they combine both entertaining and educating elements. According to Sabido, only a synthesis of both concepts efficiently delivers educational messages. Consequently, learning becomes an act of entertainment and entertainment incorporates education as one of its key elements (Burgin, 2010:230). One of Sabido's main contributions to the development of Edutainment was to reveal that

educational messages do not have to limit the popularity of entertainment programmes (Singhal/Rogers, 1999:14).

The idea of combining education with entertainment in mass media has influenced institutions like Population Communication International (PCO) and the Johns Hopkins University's Center for Communication Program (JHU/CCP) in applying Edutainment programmes in various countries, especially in India, Kenya, and Tanzania. This technology transfer from one culture to another made it clear that it is a complex and time-consuming process with mixed outcomes. Nevertheless, one result of this transfer was the gain of knowledge concerning successfully creating, implementing, and maintaining the Edutainment strategy. Many media professionals have picked up this idea since then and widely recreated it in the context of television, radio, film, print, and theatre. Even the Hollywood industry has implemented the strategy in its major movies. Norman Lear for instance used his popular TV series "All in the Family" to educate viewers about racial and ethnic prejudices. Other important issues that Hollywood producers dealt with were drunk driving, gay and lesbian rights, AIDS, child abuse, infant mortality, and drug abuse (Singhal/Rogers, 1999:15f).

For example, the Harvard Alcohol Project for Designated Drivers was responsible for the development of tougher state laws to prevent drunk driving. Working closely with network executives, creative producers and writers, the Harvard School of Public Health aimed at involving messages in the form of warnings against drinking and driving in prime-time television programmes. The concept of the designated driver was therefore established, namely a selected person refusing to drink alcohol while being in charge of driving the car. This concept was widely represented in the media, and led to higher levels of awareness and behavioural change with regard to the designated driver (DeJong/Winsten, 1990:456fff.).

The Johns Hopkins University provided another example, as they commissioned songs by popular artists in various countries to deliver messages concerning family planning. Enabling massive exposure to this content repeatedly, Edutainment eventually led to a higher sexual abstinence and the application of contraception (Backer et al., 1992:169).

Probably the most famous example of a children's Edutainment programme in the United States is "Sesame Street", created by Children's Television Workshop (CTW) in 1969. Since then, it has been watched by millions of pre-schoolers around the world and it was translated into many languages. The show proved that television cold not only teach children about specific subject matters, but also that learning can be a fun activity (Akerman et al., 2011:206). The purpose of the programme is to prepare children for classroom learning and to develop cognitive learning skills that are necessary for pre-school children. It contains the teaching of letters, numbers, geometric forms, as well as the importance of

values like kindness and cooperation, by using methods like repetition and relation to already established knowledge. To hold the children's attention, the programme makes use of various entertainment principles. Numerous entertainment formats such as animations and music are employed (Singhal/Rogers, 1999:18f.). Studies carried out about "Sesame Street" proved that viewers of the programme generally score higher results in tests of abilities in all curriculum areas (Ball/Bogatz, 1972:268). This study among others suggests that Edutainment is in fact an effective strategy. Therefore, the effectiveness of this strategy will be looked at more closely in the next chapter.

4. Effectiveness of Edutainment

Seeing these results of Ball/Bogatz (1972) and other researchers mentioned above, it has to be evaluated in more detail whether Edutainment can have actual effects on viewers. While earlier studies were concerned with explanations of effects, the 1980s marked a turning point in the Edutainment research. More and more communication researchers became involved in evaluating the effects of Edutainment messages with an emphasis on behavioural change. Various studies found out that health-related messages influenced viewer's awareness, attitudes, and behaviours (Moyer-Gusé, 2007:13). More precisely, messages embedded in entertainment television programmes were evaluated in terms of their influence on viewers in relation to awareness and attitudes towards the issues covered. Some researchers have even speculated that messages delivered through Edutainment are more effective than traditional persuasive messages because viewers are involved with its narrative structures (Moyer-Gusé, 2008:408). However, Moyer-Gusé (2008:407) states that more empirical work is needed to prove these arguments. It has to be mentioned that Edutainment does not necessarily imply persuasive intent on the part of the producer. Embedded storylines can either be placed intentionally in order to influence behaviour, or they can be added only for their dramatic appeal. Nevertheless, this does not restrict an incidentally occurrence of behaviour change (Moyer-Gusé, 2008:409). Regarding the research done, an emphasis has been put on evaluating the effects of entertainment-education in developing countries (Moyer-Gusé, 2007:15). However, there is not enough evidence provided here regarding the effectiveness of Edutainment. There is still a lot of untapped potential and a lot to learn about the best way to maximize the impact and minimize the unintended consequences of entertainment-education messages. Edutainment can, however, be considered a game-changer for development (The World Bank, 2017).

An example for an evaluated Edutainment programme is "Soul City", a prime-time TV drama series in South Africa. The programme deals with different health-related issues. Research showed that broadcasting this programme led to increased knowledge, more positive attitudes, and more positive behaviours towards certain issues (Singhal/Rogers, 2001:345f.). However, these and other results were limited in terms of generalizability, because it was hard to isolate observed effects as resulting from the entertainment programme itself and not from larger health campaigns about the issues. As most of these studies were carried out abroad, generalizability is also difficult given the unique media environment in different countries (Moyer-Gusé, 2007:15). One reason why Edutainment strategies are rarely found in the Western world is due to the difficultness to reach an audience with a lot of media options. The barrier of media saturation generally presents a

big obstacle (Sherry, 2002:206f.). Singhal/Rogers (2002:123) insist on more research to assess how television programming can combine the interests of all involved. They suggest that television producers should not concentrate on how entertainment enhances education but rather how education can improve entertainment.

To evaluate the effectiveness of an Edutainment strategy, it is important to look at particular effects that have proven to be promising. Studies have shown that Edutainment programmes may have effects on knowledge after being exposed to the media. However, there are inconsistent results whether these learning developments are persistent or not. Systematic evaluations on attitudes of entertainment-education messages are hardly found (Moyer-Gusé, 2007:16f). Studies (e.g. Farrar, 2006) suggest that television can influence the audience's attitudes and behaviours towards an issue, though more research is needed to generate specific proof of these findings. It is important to mention that knowledge about a certain issue does not automatically lead to changes in attitudes and behaviour. When evaluating knowledge about a certain issue transmitted via an Edutainment programme, it is important to also evaluate attitudes towards said issue in order to prove the effectiveness of an Edutainment programme (Moyer-Gusé, 2007:18f).

A study conducted by Bertacchini et al. (2012) in Italy about science teaching and experiments in secondary schools found out that learning motivation is linked to interest/enjoyment and competence. The more students enjoyed themselves, the higher the learning outcomes. This study shows that entertainment can in fact enhance science learning. It shall therefore be evaluated in this master's thesis if this is also the case in adult education.

4.1. Attitudes towards Science

Attitudes are best described as postures or positions adopted or expressions of views or thoughts that have an effect on behaviour, ideas or emotions (Johnston, 1997). Speaking about attitudes, they refer to people's evaluation of any given object, such as oneself, other people, possessions, issues, abstract concepts, and so on. A person's dislike of science or a favourable predisposition towards scientists are examples of attitudes (Petty/Fabrigar/Wegener, 2003:752). An attitude is "*a mental and neural state of readiness, organized through experience exerting a directive or dynamic influence upon the individual's response to all objects and situation with which it is related."* (Allport, 1935:810). Also Green (1954:336) suggests that *"the concept of attitude implies a consistency or predictability of responses".* Even though there are many opinions whether there is a relation between attitudes and overt behaviours, Fazio/Zanna (1981:163) suggest that there is a clear conceptual parallel between them.

An attitude is usually activated by exposure of the person to a particular object (Singh, 2015:201). Persuasion is said to occur when a person's attitude changes. Change can refer to moving from no attitude to having an attitude or from one attitude to another. Persuasion can either be very explicit when a strong communication process modifies someone's evaluation of an issue openly or it can be very subtle when a person's attitude changes because the subject shifts from being associated with pleasant to unpleasant outcomes. Emotions are critical to understanding attitude change (Petty/Fabrigar/Wegener, 2003:752).

Measuring attitudes is not easily done. Fabrigar/Krosnick/MacDougall (2005:18) suggest that people could simply be asked about their attitude. However, direct questions may not always lead to the most useful answers. Another approach would be to observe how people react to the issue. Nonverbal reactions can communicate a lot of information but are not easily interpreted. A third possibility is to look at more overt behaviours related to the topic as in if they would support the object being promoted for example. Because people tend to associate with others who have similar attitudes, a fourth source of information is to consider people's friends and families to get an idea of their attitudes. A fifth possibility is to ask people to make judgements about the object and to notice whether they show bias in their judgements that reflect their attitudes. Finally, it is possible to get information about people's attitudes by examining their physiological responses (Fabrigar/Krosnick/MacDougall, 2005:18). O'Keefe (2002:7) distinguishes attitude assessment by the degree of directness with which the respondent's evaluation of the attitude object is being assessed. Direct attitude measurement techniques directly ask the respondents for an evaluation of the attitude object. Of interest here are the two commonly employed direct assessment procedures: semantic differential evaluative scales and single-item attitude questions.

According to research, attitudes can be conceptualised as made up of three factors: affective, cognitive, and behavioural components. The affective component consists of positive and negative feelings associated with the attitude object. The cognitive component comprises beliefs about and perceptions of the attitude objects. Finally, the behavioural component is made up of response tendencies and overt actions related to the attitude object (Petty/Fabrigar/Wegener, 2003:752).
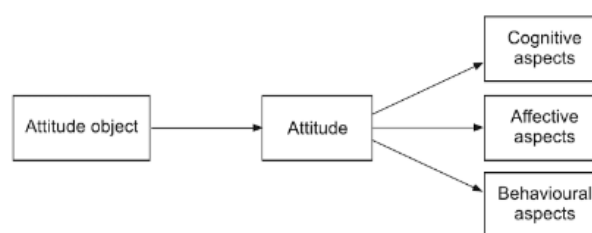

Figure 2 ABC components of attitude (Singh, 2015:197).

Measuring attitudes helps to understand if people change in response to persuasion. Another reason why we need effective measures of attitudes is that it is useful to predict behaviour. If we know people's attitudes, we will have a clue of how they will react in response to an object (Fabrigar/Krosnick/MacDougall, 2005:19).

It is widely recognised that attitudes are an important predictor of individual differences in educational application, learning, and achievement. They are not only an outcome of the learning process but also an aid to learning (Evans, 1965, in: Francis/Greer, 1999:219).

4.2. Behaviour in relation to Science

The ability of attitudes to predict behaviour is determined in part by whether the attitude is consistent with its cognitive and affective bases and whether these bases are consistent with each other (Petty/Fabrigar/Wegener, 2003:754).

Millar/Tesser (1986:189fff.) suggest that behaviours can be divided into at least two categories; instrumental and consummatory. Instrumental behaviours are behaviours that are performed to accomplish a goal independent of the behaviour itself. Consummatory behaviours are behaviours that are performed because the behaviour is intrinsically rewarding. Instrumental behaviours are primarily cognitively driven, whereas consummatory behaviours are primarily affectively driven.

The Behaviour Change Theory posits that behaviour change requires change in several factors or processes including knowledge or understanding of the importance of the behaviour, contemplation of engaging in the behaviour, self-efficacy to complete the behaviour, and readiness to complete the behaviour. Based on these factors, individuals then proceed through a series of stages including pre-contemplation, contemplation, and preparation prior to action (changed behaviour) (Sudore et al., 2013).

The most immediate determinant of such an action is the actor's behavioural intention, as in what the person intends to do. Influencing behaviour, then, is to be accomplished through influencing persons' intentions (O'Keefe, 2002:101).

Ajzen/Fishbein (1980) formulated the theory of reasoned action (TRA) to estimate the discrepancy between attitude and behaviour. When realising that behaviour is not always voluntarily and controlled, they developed the theory of planned behaviour (TpB) that predicts deliberate behaviour. The Theory of Reasoned Action suggests that a person's behaviour is determined by his/her intention to perform the behaviour and that this intention is, in turn, a function of his/her attitude towards the behaviour and his/her subjective norm. The best predictor of behaviour is therefore intention. An intention is the cognitive representation of a person's readiness to perform a given behaviour, and it is considered to be

the immediate antecedent of behaviour. This intention is determined by three factors: people's attitude towards the specific behaviour, their subjective norms and their perceived behavioural control. The theory of planned behaviour states that only specific attitudes towards the behaviour in question can be expected to predict that behaviour (University of Twente, 2017).

According to the Theory of Planned Behaviour (TpB), human behaviour is guided by three kinds of considerations: beliefs about the probable consequences of the behaviour (behavioural beliefs), beliefs about the normative expectations of others (normative beliefs), and beliefs about the presence of factors that may facilitate or prevent a performance of the behaviour (control beliefs). Behavioural beliefs create a favourable or unfavourable attitude towards the behaviour, normative beliefs result in perceived social pressure or subjective norm, and control beliefs give rise to perceived behavioural control. In combination, attitudes towards the behaviour, subjective norm, and perception of behavioural control lead to the formation of a behavioural intention. The more favourable the attitude and subjective norm, and the greater the perceived control, the stronger should be the person's intention to perform the behaviour in question. As a result, people are expected to carry out their intentions when the opportunity arises. Intention is thus assumed to be the immediate antecedent of behaviour. However, it is useful to consider perceived behavioural control in addition to intention (Ajzen, 2006:1).
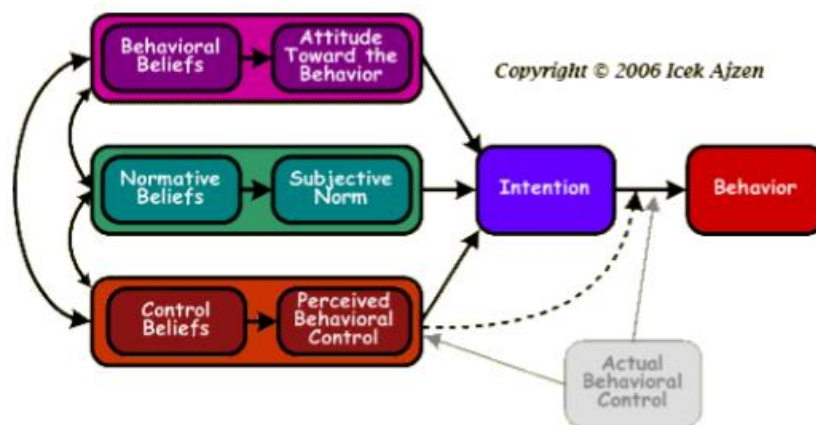

Figure 3 Theory of Planned Behaviour (Ajzen, 2006:1).

4.3. Critical perspectives on Edutainment

Edutainment and its strategies are not always met with enthusiasm. Educational professionals are often in opposition because the general trend of increasing entertainment is considered a problem (Walldén/Soronen, 2004:4).

Postman (1985:16) feared in his infamous book "Amusing ourselves to death" the danger of a cultural change from a content-oriented to an entertainment-oriented society. According to Postman, entertainment has always been in the foreground as opposed to educating or informing the public and has intoxicated the Western culture. It distracts from important aspects of human's lives. For him, it is a problem that every issue is presented as entertainment and that Edutainment programmes are not an adequate alternative for content-only formats (Postman, 1985:110).

Russell (2000:389f.) too fears that a shift from a vertical pool of knowledge that represents deep wisdom to a horizontal pool that consists of unrelated scraps of information is happening. A result of that is a lack of continuity in cultural understanding. Quoted in Wall-dén/Soronen (2004:4), Brown and Duguid (1999) further state that learning is a psychological process and complicated matters cannot be learned easily and quickly like it would be the case with Edutainment.

The production of TV programmes relies heavily on music and fast changing images to entertain the audience. These elements can make it difficult to grasp the meaning of the transmitted information, and, moreover, to reflect upon it, and to confront it consciously. The fluent overlap between medial and actual reality might be an impossible task for a laymen to realise where the show begins and ends (Klöppel, 2008:124). The result of this development is that an irrigation of information takes place. It may lead to an apathy of the recipients, a reduction of the ability to act, a decreased autonomous critical ability, and a limited rationale power of judgement in society (Buß, 2012:319). Television was not invented for idiots, it rather produces them (Klöppel, 2008:123).

Liessmann (2006:8) argues that media provide knowledge that is adapted to their structure. Content is expressed in a fast pace to establish a fluent communication. Moreover, knowledge here is easily generated and adapted, but also easy to forget. The media have to provide information that corresponds with the desires and needs of the audience. Competition and self-financing challenges force especially private broadcast stations to focus on quota (Galter, 2002:52).

Summer (2008:22fff.) adds that the primary motivation of the market is to satisfy the needs of anyone who can afford the product. Education, on the other hand, is to satisfy the desire for knowledge of anyone who seeks it regardless of financial means. Transmitting education via television therefore creates a discrepancy.

Via Edutainment, gaining knowledge should be a fun activity that provides entertainment. It should be presented in an exciting manner, so explanations are often replaced by stunning pictures (Galter, 2002:53f.). Also, teaching has to link new knowledge to existing

thought patterns and experiences. Knowledge provided by the media, however, is generated more or less for an anonymous market so prior knowledge cannot be identified (Lisop, 2002:18f.).

Bagust (2008:214) points out that studios manipulate images of nature and other subjects in order to make them more consumer-friendly and more economically valuable. This can lead to the fact that commercial interests are rather supported than educational aspects. More importantly, credibility associated with something called "educational" is misused. These critical aspects of Edutainment should be considered in the course of this master's thesis. Nevertheless, this study rather focuses on the positive characteristics that have an impact on science teaching.

5. Theoretical framework of Edutainment

Theorizing Edutainment began with Miguel Sabido's analysis of the Peruvian soap opera „Simplemente María", as he was amazed by the degree of prosocial change following its reception. His analysis was intended to develop a theory (explained below) for generating successful prosocial soap operas (Singhal/Rogers, 1999:14).

Since then, many researchers around the world have investigated into this particular field, and have used different theories according to their perspective and approach. A vast majority of researchers applied steps or stages models, analysing which steps individuals pass through when they adopt or maintain a (new) behaviour. Another branch of scientists occupy themselves with social psychological studies in order to explain the (expected) behavioural outcomes caused by perceptions and elements of viewer's social environment. Psychological models observe internal processes of the mind during the exposure to Edutainment. Drama or role theories examine different roles and scripts of characters and television depiction. In order to analyse how entertainment-education programmes can have effects on viewers, audience-centred theories serve as a basis for analysis. Last but not least, contextual theories examine Edutainment via a broader perspective, trying to explain the connection between society, institutions, and other contextual factors and television programmes (Sood/Menard/Witte, 2004:123). This chapter will therefore give an overview of the different approaches chosen to understand the principles of Edutainment.

5.1. Steps/Stages Models

McGuire (1989) developed the Hierarchy-of-Effects Model to describe the mechanism of the effects of mass media interventions. On the one hand, input factors measured include variables such as source, message, channel, and receiver, and output factors, on the other hand, describe the steps an individual has to take to when being persuaded to assimilate a desired behavioural change. These steps include the exposure to the message, the attention to the message and, consequently, the interest in this message. Furthermore, it is measured whether the message is of personal relevance to the viewers and whether it is understood properly. The individual has to personalise the proposed behaviour to fit her or his lifestyle and therefore accepts the change. To make decisions based on bringing the message to mind, viewers have to remember the message, continue to agree with it and behave as decided. It is also evaluated if participants receive (positive) reinforcement for behaviour change (Sood/Menard/Witte, 2004:123). Therefore, information has to be

presented, then attended to, then comprehended. Once comprehended, the recipient must give in to the message, retain it, and then, behaviour occurs (Barry, 2012:266)

Rogers (2003) invented the diffusion of innovations theory to describe the steps an innovation has to go through. According to that, it has to be communicated through certain channels, over time, among the members of a social system. In addition, the innovation-decision-process describes the steps of an individual reacting to that invention, starting from first knowledge of it, to forming an attitude towards it, and ending at making a decision to either adopt or reject said innovation. Further steps include the implementation of the new idea and confirmation of the decision being made (Sood/Menard/Witte, 2004:123f.). These and various other stages models help to define the different elements playing important roles during an exposure of an Edutainment programme, especially with regard to the part of audiences in the process of change. The purpose of these theories is to help designing messages in order to fit specific audience needs. These models are equally important when it comes to feedback and corrections of Edutainment programmes (Sood/Menard/Witte, 2004:124). Moreover, they also help to establish an experimental setting concerning Edutainment.

5.2. Social psychological theories

Researchers who apply social psychological theories are concerned with an individual's beliefs and perceptions regarding their social environment (Sood/Menard/Witte, 2004:124).

The most frequently employed theory to explain Edutainment in this context is the Social Cognitive Theory by Bandura (1986), based on his Social Learning Theory (1977). According to this theory, people learn by observing others' actions and its outcomes, observational learning as it were. This type of learning occurs because people are motivated by outcome expectancies and self-efficacy. Therefore, a person who observes a model whose behaviour is rewarded, is more likely to imitate seen behaviour. Similarly, observing an accomplishment of a model similar to a viewer can increase the viewer's self-efficacy and self-confidence to perform the behaviour. Self-efficacy, according to social learning theory, represents an individual's belief in his or her own ability to perform an action. Self-efficacy is considered to be the driving force for human behaviour change. „*Efficacy expectations are a major determinant of people's choice of activities, how much effort they will expend, and of how long they will sustain effort in dealing with stressful situations.*" (Bandura, 1977:194) Besides self-efficacy, the concept of outcome expectations is another element of the Social Cognitive Theory. Outcome expectations refer to the belief that a

certain behaviour will lead to a certain outcome. In an Edutainment programme, television characters act as models by showing audiences that they are able to carry out an action, hence generating self-efficacy, and that this action leads to a certain positive outcome, thereby enhancing outcome expectancies (Sood/Menard/Witte, 2004:125). Motivation, as a final characteristic, can be influenced by both outcome expectancies and self-efficacy, determining whether proposed behaviour is carried out or not (Bandura, 1977:194).

This and other social psychological theories, in summary, aim at explaining why behaviours may or may not change in response to an Edutainment programme. Acting on the assumption that an individual's perception, his or her beliefs and values are the driving force for behavioural change, these models play an important role in comparing them to a programme's advocated behaviour. These theories are important when measuring individual levels of perceived threats, attitudes, subjective norms, and values occurring during an exposure to an Edutainment programme (Sood/Menard/Witte, 2004:126).

5.3. Drama Theories

Drama theories examine the roles that people play and the scripts they follow in their daily lives (Sood/Menard/Witte, 2004:128). Of interest here is especially Jung's theory of the collective unconscious (1970), because he suggested that there are certain scripts or stories with familiar patterns and characters that people have acted out throughout history. These familiar stories and characters serve as a basis for many myths, legends, and folktales. Jung called these universal scripts the "archetypes of the collective unconscious", having the same or similar characters no matter where they are told. Examples for that would be "prince charming" or the role of "the mother". Jung's characters with universal psychological and physiological characteristics serve as models for developing characters in Edutainment programmes (Sood/Menard/Witte, 2004:127).

Another drama theory is Bentley's dramatic theory (1967), where five different types of drama are established: tragedy, comedy, tragicomedy, farce, and melodrama. By defining each structure and effect, he created a basis for designing negative and positive characters and plots (Sood/Menard/Witte, 2004:128).

Kincaid (2002:150) developed the Drama Theory that suggests that individuals pass through stages of scene setting, problem build-up, climax, conflict, resolution, and then ultimately, implementation of a new collective action. Of special interest here is the stage of climax of problems and conflicts, where emotions and reasoning lead to changes in values, beliefs, and new attitudes. Confrontation is a basic element of every drama as it is necessary to generate emotions, which in turn are necessary to enable motivation. This

motivation then leads to a form of action of the characters and consequently to the reso-
lution of problems.

Drama theories are important for the creative development of Edutainment programmes.
Narratives and their ability to trigger emotions are useful to develop successful pro-
grammes that can change or promote values, beliefs, and behaviour (Sood/Menard/Witte,
2004:129).

5.4. Psychological Models

Research that is based on psychological models is particularly concerned with the specific
psychological processes viewers pass through when being exposed to an Edutainment
programme (Sood/Menard/Witte, 2004:126).

One very important model is the Elaboration Likelihood Model by Petty and Cacioppo
(1968) which states that people will think carefully about the arguments of a message
when they are motivated and able to process said message. Furthermore, they will elabo-
rate and critically evaluate it. There are two key paths of information processing: the central
path and the peripheral path. Central processing of messages leads to stable and sus-
tained attitudes and behavioural changes. If people are unmotivated or unable to process
the message, the peripheral path is used. There, audiences will rely on cues when evalu-
ating arguments in a message as they are not able or willing to do it alone. One of these
cues could be an expert who affirms the arguments of the message. Peripheral paths are
unstable and the behaviour is more likely to change upon receiving a new message
(Sood/Menard/Witte, 2004:127).

In addition, the Extended Elaboration Likelihood Model (Slater/Rouner, 2002), based on
central and peripheral routes of message processing, states that a viewer's engagement
in the narrative and identification with characters reduce counter-arguing. Edutainment
therefore has the ability to influence beliefs, attitudes, and behaviours by reducing counter-
arguing to messages, a form of resistance (Slater/Rouner, 2002:180). When viewers are
engaged in the dramatic elements of an entertainment programme, they are placed in a
state of less critical, more immersive engagement (Shrum, 2004). Engagement will only
occur when the storyline is appealing, the quality of production is evaluated positively, and
the "*unobtrusiveness of persuasive subtext*" is given (Slater/Rouner, 2002:178).

Audiences are not only interested in televisual characters, they also engage with them
interpersonally. As Roman suggests, "*television programs and characters have a unique
ability to become an intimate part of a household and family.*" (Roman, 2005:130) Because
of the cumulative pattern of television series, like multiple seasons and episodes, they can

capture an audience's involvement in a way that is rarely seen in other contemporary media (Creeber, 2004:4). In other words, viewers build up a particular close and intimate relationship with characters in TV fiction (Wickham, 2007:91f.). Edutainment therefore blocks counter-arguing and provides an opportunity to influence individuals who would normally be resistant to persuasion (Slater/Rouner, 2002:180).

Another important psychological model is the Theory of the Triune Brain (McLean, 1973:165). According to that, messages can be processed via three separate brain centres, namely in a cognitive, affective, and animalistic way. People think about the message via the neo-cortex centre. When messages are received via the visceral area, emotions are generated. In the reptilian centre of the brain, messages evoke physical reactions, such as basic instinctual urges like hunger, need for sex, or aggressive behaviour (Sood/Menard/Witte, 2004:127).

Psychological models in general help to understand the mental processing of Edutainment programmes. They make clear that studying audience predispositions and brain biology will bring about advantages when trying to fit an Edutainment message into pre-existing cognitive schemas (Sood/Menard/Witte, 2004:127f.).

5.5. Sabido's Methodology

Miguel Sabido made use of five different theories to develop his own methodology describing Edutainment (Population Media Center, 2016). First, he took the step/stages model of Shannon and Weaver (1949) and arranged the steps of communicator, message, medium, receiver, and noise in a circular process. This way, the factors engage in a direct interaction with one another, producing communication effects. Sabido used this model to design complex and multi-layered telenovelas (Sood/Menard/Witte, 2004:124). He described the communicator as the manufacturer of a product, the message, the medium as the television programme, and the response as the purchase of the advertised product and television ratings. He also used Paul Lazarsfeld (1944) two-step flow theory of communication that states that messages first reach a minority of receivers who will subsequently communicate it to others. Audience members often conduct discussions regarding social issues that they have seen previously on television. Hence, models on TV serve as examples on how to discuss certain issues (Population Media Center, 2016).

The next theory Sabido integrated into his methodology is the Dramatic Theory by Bentley (1967), as explained above. He especially used melodrama for designing telenovelas (Sood/Menard/Witte, 2004:128). The melodrama creates tension by having good and evil characters. Sabido placed the audience in the heart of this conflict by representing them

through a third party – one character that is uncertain about the social behaviour in question. This character is intended to serve as a possibility for identification and will guide the audience members towards an adoption of desired behaviour changes (Population Media Center, 2016).

The third theory which is used is Jung's Theory of the Collective Unconscious (1970) and it describes characters that embody universal psychological and physiological characteristics. Through these characters, the audience members can find similarities to an archetypical essence of themselves. The aim of this theoretical application is to make identification between viewers and characters possible (Population Media Center, 2016).

Sabido also applied Social Learning Theory (1977) and Cognitive Social Theory (1986) by Bandura. These models help to analyse symbolic interaction between people. *"[I]n this dynamic interplay, personal agency [the ability to act] and social structure operate as interdependent determinants in an integrated structure rather than as a disembodied duality"* (Bandura, 2004:76). By punishing a role model for practicing a socially undesired behaviour in a television programme, it should prevent audience members to practice the same evil behaviour. Contrariwise, positive rewards for the actions of a TV character will motive the audience members to behave likewise. This adoption is called modelling and is, according to Sabido, necessary for viewers to acquire new forms of behaviours and to teach audience members (Population Media Center, 2016).

Sabido also used the Triune Brain Theory by MacLean (1973) as the last theory implemented to describe why some programmes fail to change behaviours. His approach to designing soap operas was that programmes had to draw on all three brain centres in order be successful, not just the cognitive processing. Therefore, Sabido developed programmes that prompted intellectual, emotional, and physical responses (Sood/Menard/Witte, 2004:127).

In summary, Sabido's methodology uses elements of communication and behavioural theories in order to develop entertainment-education programmes. Specific values, attitudes, and behaviours can therefore be implemented into TV programmes and serve viewers for their own personal advancement (Population Media Center, 2016).

5.6. Audience-Centred Theories

The purpose of audience-centred theories is to describe how audiences interact and react to Edutainment programmes (Sood/Menard/Witte, 2004:129).

To provide a basis for audience-centred theories, the Uses and Gratification Approach has to be elaborated. Its approach is that the audience is the centre of perspective. The focus

is laid on what the audience does with media, not the other way around. Assuming that people are active media users who are driven by their needs, they will seek access to the media in order to gratify those needs. Edutainment programmes meet some of this needs like entertainment (to seek fun or excitement), escapism, information, identification, social interaction, and others. The more needs the programme meets, the greater the post-exposure effects (Katz/Foulkes, 1962:378).

The two-step flow model (Lazarsfeld/Berleson/Gaudet, 1944), also implemented by Sabido, proposes that mass media only have minimal direct effects on audience members, and that audiences are instead more likely to be influenced by opinion leaders (persons in positions of influence). According to this theory, opinion leaders receive information directly from the media and then pass it on to others. The key to behaviour change is therefore interpersonal communication, for example in social networks (Sood/Menard/Witte, 2004:130).

5.6.1. Audience involvement

One of the basic principles of audience-centred theories is audience involvement. Based on the Elaboration Likelihood Model, it is defined as the engagement of audience members in reflection upon media programmes, resulting in behavioural change (Sood/Menard/Witte, 2004:129). Referential reflection describes the process of relating the programme to personal experiences, whereas critical reflection denominates the act of using one's own thoughts and imaginations to make sense of a message (Sood, 2002:153fff.).

5.6.1.1. Narrative Involvement

One important key element of the audience involvement theory is narrative involvement. Due to the narrative structure of entertaining programmes, Edutainment messages convince viewers to involve in the storyline. It focuses on the interest with which viewers follow the events as they unfold in the story (Moyer-Gusé, 2008:409). Audience members experience cognitive and emotional reactions while engaging in a storyline. Traditional campaigns convey abstract concepts and can become quickly repetitive. Educational narratives, on the other hand, are easier to follow and to remember than abstract information (The World Bank, 2017).

A common term used in this context is transportation (Green/Brock, 2000:701). It describes the process of being "swept up" into a storyline instead of being aware of the immediate environment. Transportation plays an essential role in distinguishing Edutainment messages from overtly persuasive messages (Moyer-Gusé, 2008:409). Basically, the

main mechanism of transportation is distraction. Distraction has the ability to reduce counter-arguing and therefore increases persuasion (Knowles/Linn, 2004). It has been linked with viewer's knowledge gain from narrative messages (Murphy et al., 2013). Transportation Theory is concerned with the causes and consequences of an individual being immersed in a story, or transported into a narrative world. This experience is a key mechanism underlying narrative influence on recipients' attitudes and beliefs, particularly in combination with enjoyment and character identification. Transportation can occur across media and for both factual and fictional stories. While individuals are transported, their mental systems and capacities become concentrated on events occurring in the story, causing them to lose track of time and awareness of the surrounding environment. They experience thereby powerful emotions as a result of their immersion in the narrative. Transported recipients may also lose some access to real-world knowledge, making them more likely to adapt their actual beliefs and behaviours to be more consistent with the story they are exposed to. Transportation theory suggests several mechanisms to explain this phenomenon, including reduced counter-arguing, connections with characters, heightened perceptions of realism, the formation of vivid mental imagery, and emotional engagement. In summary, it is suggested that stories that are more transporting will be more effective at generating attitude or behaviour change (Green/Fitzgerald, 2017).

To grasp the concept of narrative involvement in a better way, it is important to define what a narrative is. For centuries, stories have been a primary means of communicating information. Oral storytelling made it possible for individuals to share and pass down knowledge before written communication was established, and even today, stories are a central part of interpersonal and mass communication. An important function of stories is to persuade. Individuals' attitudes and beliefs can be shaped by the stories they hear (Green/Fitzgerald, 2017).

In general, a narrative consists of characters, actions, time, place, and causality (Mason, 2005:53). Basically, the primary purpose of a narrative format is to tell a story. A story is a composition of a string of events, taking place in a certain space and time. Moreover, these events do not occur randomly, they rather present an ordered series connected by the logic of cause and effect. Events are linked together in a linear way that display reasons and consequences of character behaviour for the audience. This logic of cause and effect is responsible for the character traits, goals, obstacles, and actions to be comprehend as a whole. A narrative is generally centred on human characters and their struggles. These characters are constructed by giving them traits and conflicts to face. They have to perform actions and undergo changes that enable or hinder their pursuit of a specific goal. All narratives involve, in accordance with drama theory, the disruption of a stable situation, which

makes the restoration of an equilibrium an important goal of characters. They therefore must encounter obstacles in order to achieve goals (Mason, 2005:33f).

The implied world of the story - including settings, characters, sounds, and events - is called diegesis. Elements that exist outside the diegesis are denominated non-diegetic devices. For example, communicating with the audience directly is a non-diegetic element. Most narrative films tell a story by simple showing a sequence of actions, but others include a narrator, like a non-diegetic voice-over (Mason, 2005:34f.). However, a narrative is usually characterised by an "unobtrusive craftsmanship", meaning that stories are told in a manner that draws viewers into the diegesis and does not make the storytelling process visible (Mason, 2005:46).

Another aspect of a narrative is the concept of time. Time is divided into screen time and time in the plot. Films do not depict every moment of their characters' lives, but present certain events while others are omitted. The complete and chronological story is called the fabula and it is abbreviated and reorganized into a version of events that only play out on screen for the audience, called syuzhet (Todorov, 1977). While syuzhet selects and orders the actions explicitly presented on screen, the fabula also includes events that are only implied and not presented (Mason, 2005: 36).

The narrative structure usually contains a three-act structure. Act one introduces the characters, goals, and conflicts and ends with a first turning point. A turning point may be signalled through dialogue, setting or other visual or sound techniques, and represents a moment when an important change has occurred that affects a character or a situation. During that phase, the character meets obstacles and is confronted with conflict. This act two ends with a climax. In act three, the dénouement, a series of events occur that resolve the conflict, not necessarily in a happy outcome. This concluding moment ties up all the loose ends, leaving no unanswered questions. It marks a closure (Mason, 2005:38).

Narrative transportation refers to the experience of being consumed by the world of a narrative, of being so immersed in a story that a connection to the real world may be lost for some time. As long as a narrative structure is present, it is possible that transportation is also present. Narrative structure is used as a tool for a various communication genres, including entertainment (e.g. television series) (Green/Fitzgerald, 2017).

5.6.1.2. Involvement with characters

The other principle of audience-centred theories is the involvement with characters. Edutainment programmes facilitate various forms of this kind of involvement. To evaluate the involvement with characters, several factors have to be evaluated. Characters in mass media have the power to be role models, inspire audiences to engage in new thinking, and change the perception of what is "normal" and socially acceptable (The World Bank, 2017).

According to Cohen (2001:258), identification has to be understood as an emotional and cognitive process during which the viewers slip into the roles of the characters they are watching in the narrative. While exposed to the programme, the viewers forget their own realities and, temporarily, turn into those characters. During this process, they share feelings with the character (empathic), the character's perspective (cognitive), and the characters goals (motivational) and thus lose self-awareness (absorption). Narrative genres are more likely to generate identification. Programmes where characters speak directly to their viewers remind them constantly of their role as an audience, which limits identification. Consequently, identification requires audience members to imagine themselves as the character, and therefore, similarity should increase effects (Cohen, 2001:258). Identifying with a character is a mechanism "*through which audience members experience reception and interpretation of the text from the inside, as if the events were happening to them*" (Cohen, 2001:245). One basic dimension of identification is emotional empathy, as in the ability to feel what the characters feel and become effectively involved in a vicarious way, Secondly, cognitive empathy is required, as in adopting the point of view of a character or putting oneself in the place of the character. Ideally, they share or internalise the character's goal and absorb it (Cohen, 2001:258fff.).

The concept of similarity, which facilitates identification, describes the degree to which viewers perceive them to be similar to the characters they are watching. This similarity concerns physical attributes but also personality, beliefs, etc. (Eyal/Rubnin, 2003). Viewers typically go through a cognitive evaluation of what they have in common with a certain character. However, this does not mean that they lose their own perspective during this assessment of similarity (Cohen, 2001). Hoffner and Cantor (1991:87) argue that similarity to a media character promotes a desire to be like them, as certain similarities indicate that it is appropriate and possible for the viewer to become like the character.

Wishful identification, as another element of character involvement, is based on the Social Cognitive Theory (Bandura, 1968) and explains the process of viewers wishing to be like the character with a "*desire to emulate the figure*" (Giles, 2002:12). Viewers therefore admire the character (Lonial/Van Auken, 1986). Many studies involving children have examined the traits and behaviours of media characters that influence wishful identification. According to Hoffner and Buchanan (2005:330), traits like intelligence, success, attractiveness and humour are characteristics that have proved to be important in forming impressions of others.

Parasocial interaction is defined as "*the seeming face-to-face relationship between spectator and performer*" (Horton/Wohl, 1956:215). It describes the (pseudo-)relationship and interaction between an audience member and a distant media figure (Blumler/Katz, 1974).

These parasocial relationships are similar to a normal interpersonal relationship with regard to their characteristics, except that they are not reciprocated by the TV character (Giles, 2002:12). Reasons for the existence of such relations of friendship and intimacy are that viewers seek guidance from the characters. They represent a part of their social world (Hoffner, 1996). Parasocial interaction can lead to cognitive, affective, and behavioural participation, and therefore play an important role in analysing the effects of Edutainment programmes (Sood/Menard/Witte, 2004:129).

Liking, as another element of character involvement, refers to positive evaluations of a character (Cohen, 2001). Viewers form a positive opinion about the characters depicted which can then lead to a parasocial relationship (Moyer-Gusé, 2008:411).

5.6.2. Involvement-Resistance Model

Moyer-Gusé (2007:25) extended these audience-centred theories and developed the Involvement-Resistance Model to evaluate the influence of entertainment programmes. The elements of narrative structure, identification, wishful identification, similarity, parasocial interaction, and liking are used in order to evaluate how entertainment can overcome resistance. Resistance is seen as a reaction against change, provoked by a perceived pressure for change (Knowles/Linn, 2004).

Persuasion is an essential part of human communication, albeit we often rather resist than embrace persuasive attempts (Fransen/Smit/Verlegh, 2015). The Psychological Reactance Theory postulates that humans have a basic need for freedom, and to choose their own attitudes and behaviours (Brehm, 1966). Thus, reactance, a form of arousal, occurs when this freedom is being threatened. According to this theory, persuasive communication is often perceived as a threat to one's freedom, even if the message's recommendation is in the receiver's best interest (McGrane/Toth/Alley, 1990:235fff.). Persuasion is understood as a successful intentional effort of influencing someone's mental state through communication. In these situations, however, the person being persuaded keeps some measure of freedom. It has to be mentioned that the concept of persuasion is still a fuzzy one (O'Keefe, 2002:5).

As explained above, without measuring attitudes, one cannot tell whether a given persuasive effort has induced any attitude change (O'Keefe, 2002:6). Persuasion attempts may be poorly designed or executed, or their impact may be reduced by interfering influences from other sources (Fransen/Smit/Verlegh, 2015).

Theoretical research suggests that entertainment messages, using a more subtle form of persuasion, may overcome this type of reactance. Edutainment uses an implicit intent to

influence and overcome reactance by using a narrative format. Viewers are more likely to oversee the intention of the programme, due to transportation, and to change their attitudes or behaviours. Messages embedded in news-style formats, on the other hand, tend to provoke reactance. We can therefore say that the less overtly persuasive a message is perceived to be, the more accepting receivers are to the influence (McGrane/Toth/Alley, 1990:235fff.). Thus, entertainment programmes do not induce this kind of reactance.

Furthermore, the model concentrates on the reduction of counter-arguing through transportation, identification and parasocial interaction. Trust and familiarity with characters lead to the willingness to accept even persuasive information without generating counter-arguments (Moyer-Gusé, 2008:416). It also suggests that enjoyment and identification reduce selective avoidance of certain contents because of inertia and fear. Inertia is the idea of individuals striving to keep their attitude system in balance and resisting persuasion based on their desire to avoid dissonance. Fear also leads to selective avoidance because viewers tend to be scared of health or prosocial messages, for example (Moyer-Gusé, 2008:415ff.) Witte (1994) argues that topics that arouse fear will lead to individuals ignoring the message. Furthermore, the model predicts that viewers will resist persuasive information due to perceived invulnerability. According to Goossens et al. (2002), an individual believes to be invulnerable and, as a consequence, negative implications of a risky behaviour will not apply to him or her. However, if they think they are similar to a character portrayed to be vulnerable and, moreover, identify with him or her, they are more likely to show vulnerability (Moyer-Gusé, 2008:418).

In addition, parasocial interaction can change perceived norms. If a risky behaviour is considered to be normative, resistance to a persuasive message is more likely to occur. When a viewer interacts, on a parasocial basis, with a character that contradicts the existing perceived norms, he or she is more likely to change them (Moyer-Gusé, 2008:419). The model also states with regard to Bandura (1986), that perceived similarity and identification are able to change self-efficacy and outcome expectancies (Moyer-Gusé, 2008:415).

Entertainment Feature	Resistance	Outcome

Narrative Structure; Parasocial Interaction; Liking — Reduces → Reactance

*Transportation; *Identification; Parasocial Interaction — Reduces → Counterarguing

Enjoyment; Identification — Reduces → Selective Avoidance

Perceived Similarity; Identification — Increases → Perceived Vulnerability

Parasocial Interaction — Changes → Perceived Norms

**Perceived Similarity with an Efficacious Character — Increases → Self-Efficacy

**Perceived Similarity **Identification — Changes → Outcome Expectancies

→ Story-Consistent Attitudes and Behaviors

* Predicted by the Extended Elaboration Likelihood Model
**Predicted by Social Cognitive Theory

Figure 4: Involvement-Resistance Model (Moyer-Gusé, 2008:415).

In summary, audience-centred theories are important in this field of study because they describe concepts that allow scholars to examine how audiences use Edutainment messages (Sood/Menard/Witte, 2004:130).

5.7. Contextual Theories

Contextual theories include humanistic and critical perspectives like the theory of power (Sood/Menard/Witte, 2004:130). Power has to be understood as a force or ability to influence someone to take an action that would otherwise not take place. Power operates in the field of contexts and relationships. The process of empowerment occurs when an in-

dividual gains the ability to exercise power. This ability is acquired when someone becomes an expert regarding a certain issue or when all the relevant information is being obtained. By developing alliances, rewarding others for their good work, and demonstrating active involvement in a group, power is being exercised. The media symbolizes this power and dominant structure in society, however, it also has the ability to act as a force that challenges the existing power structure (Mumby, 1988). The role of the media is seen as vital in constructing or opposing beliefs, values, and norms. Edutainment might examine issues of gender equality, for instance, under a hegemony perspective. It is therefore able to tackle existing power structures (Sood/Menard/Witte, 2004:131).

Another contextual theory is the social constructionism perspective. Meaning und understanding always derive from social context. According to that, both concepts are not constructed within the Edutainment programme, the audience, nor the media, but develop from an interaction between these three components. The specific socio-cultural environment also plays an important role here. Locally situated knowledge, beliefs, and customs are always present in Edutainment messages (Davenport-Sypher et al., 2002).

Theories based on the sociocultural context regard the media as a powerful tool, and they recognise audience members as key participants in the meaning derived and the behaviour change proposed by the Edutainment process (Sood/Menard/Witte, 2004:131).

In conclusion, all the above mentioned theories in this chapter are relevant when analysing Edutainment and can help to plan a research design in order to evaluate Edutainment programmes. The following chapter is concerned with the methodology of this master's thesis and will therefore explain which theories will form part of this research at hand.

6. Research design and methodology

After having examined the research done on Edutainment and all the underlying theories supporting these studies, the next step is now to determine the empirical construct of this master's thesis. The purpose of this study is to examine whether the Edutainment strategy works in the field of science learning. As various studies mentioned above have shown, Edutainment can have an effect on viewers, however, more research is needed to fortify this theory and to understand these effects in a more specific way. Studies so far have been focussing on changes in attitudes (and behaviours). This master's thesis will pick up attitudes as well, but will also zoom in on knowledge as a crucial part of education.

6.1. Measures

Consequently, the first and main research question is concerned with the effects of the Edutainment programme examined. To find out whether effects can be linked to Edutainment, a scientific programme will serve as a means for comparison.

Q1: What effects can an Edutainment programme have on viewers in contrast to a scientific programme?

Proposition 1: When exposed to an Edutainment programme, viewers will experience more effects than viewers of a scientific programme.

P1a: When exposed to an Edutainment programme, viewers will gain more knowledge about the scientific topic presented than viewers of a scientific programme.
P1b: When exposed to an Edutainment programme, viewers will form a more positive attitude towards the scientific topic than viewers of a scientific programme.

As the literature research has shown, knowledge cannot be directly observed and must be inferred from observing performances on a test. For that reason, a questionnaire will be designed to determine the beliefs of a person regarding the specific issue (Hunt, 2003:102f). It will therefore be evaluated whether the programme sparked an interest in the topic (McGuire, 1989; Foster, 2008:600) and whether the message presented is of personal relevance (McGuire, 1989; Sood/Menard/Witte, 2004:123). In addition, it must be observed if the message is understood properly, e.g. if they are able to remember it after exposure (Sood/Menard/Witte, 2004:123). As Rogers (2003) put it, after the person gained knowledge about the topic, an attitude is formed about it, which then can lead to (intentional) behavioural change.

To determine whether effects are present, it has to be examined whether the scientific topic has already been known before and/or whether the knowledge about the topic has increased (Hunt, 2003:102f). Therefore, a rather abstract and complex scientific topic is selected (see chapter 6.3.) that is most likely new to the viewers as it is quite advanced. It will also be necessary to examine past television exposure of the programmes (Moyer-Gusé, 2007:45).

The question that arose is how to measure attitudes towards science in general. As already explained in chapter 4.1., attitudes are based on affective, cognitive, and behavioural components. A study from Johnston (1997) focuses on five dimensions reflecting the inter-relationship between affective, behavioural, and cognitive attitudes towards science. These dimensions are derived from Fraser's Test of Science-Related Attitudes (1981) which has been substantially used and validated. They comprise the sub-dimensions "Views of Science and Scientists", "Attitude to Scientific Inquiry", "Adoption of Scientific Attitude", "Relevance of Science", and "Social Implications of Science". These dimensions are the most fitting ones with a wide range of individuals as participants. Johnston used statements from TOSRA (Test of Science-Related Attitudes) and related them to those five dimensions to create a Likert-type questionnaire (strong agreement to strong disagreement).

To evaluate if positive attitudes have formed because of Edutainment, it will be examined in accordance with the Extended Elaboration Likelihood Model if students recognised the programme as entertaining (Slater/Rouner, 2002). For that reason, the stimulus material will be selected according to its narrative structure and depiction of characters. Two different experimental groups will be generated, each one being exposed to either a sitcom ("The Big Bang Theory") or a science television magazine ("Terra X Lesch & Co"). To justify their usage, the subchapter "stimulus material" will examine their narrative structure and display of character(s). Both programmes will carry the same scientific concept and depiction of scientists, embedded in different formats, to allow a comparison of Edutainment level.

Q2: Does involvement in narrative and with characters correlate with positive effects on viewers?

Proposition 2: The more involvement in narrative and with characters, the more viewers will experience knowledge gain and positive attitudes.

P2a: The more involvement in narrative takes place, the more effects on knowledge gain.
P2b: The more involvement in narrative takes place, the more effects on positive attitudes.
P2c: The more character involvement a programme makes possible, the more effects on knowledge gain.
P2d: The more character involvement a programme makes possible, the more effects on positive attitudes.

The distinction between education-only and entertainment-only programmes is based on the possibility of narrative and character involvement. Narrative structure will be defined according to Mason (2005), as it is shown in the subchapter "stimulus material" below. Narrative involvement will be measured according to Busselle/Bilandzic (2009) and their narrative engagement scale. Their aim was to understand a story's ability to influence audiences by making use of the concept of transportation (Green/Brock, 2000), identification (Cohen, 2001), presence (Biocca, 2002), and flow (Csikszentmihalyi, 1997). Furthermore, their scale should identify the facilitation of persuasion and reality construction. The authors state that participants who are more engaged in a narrative have reported stronger story consistent attitudes. Their 12-item-scale includes subscales like narrative understanding, attentional focus, narrative presence, and emotional engagement (Busselle/Bilandzic, 2009:321fff.).

To evaluate the involvement with characters, factors like identification, wishful identification, similarity, parasocial interaction, and liking will be integrated into the questionnaire, as Moyer-Gusé (2008) suggests. As the concept of identification (Cohen, 2001) has already been implemented in the narrative engagement scale by Busselle and Bilandzic (2009) it shall not be presented again. First, participants will be asked if they liked a specific character or the TV presenter. By means of a study by McCroskey/Richmond/Daly (1975), interviewees will be asked about their perceived similarity to this character. The scale had initially four dimensions, but was reduced to two because the other ones were perceived as too unstable. The remaining subscales are "Attitude homophily scale" and "Background homophily scale" (McCroskey/Richmond, 1979). In a next step, wishful identification will be evaluated according to a scale by Hoffner/Buchanan (2005). Finally, the construct of parasocial interaction will be measured with a scale by Rubin/Perse (1987).

As educational achievement is still related to social class and prosperity, meaning that people deriving from wealthier families have more possibilities in their educational formation, it is of interest whether Edutainment messages also have different learning outcomes regarding social class. For that, a distinction will be made between the results of test persons with lower and higher education, especially with regard to the fact that people with a lower education have a higher exposure to television. Educational level is used as a measure for social class according to Wood (2011:12f.).

Q3: Which effects has Edutainment on people from different social classes?

Proposition 3: Edutainment messages can have positive effects on people with a lower education in comparison to people with a higher education.

P3a: Edutainment messages can have positive effects concerning knowledge of science on people with lower education in comparison to people with a higher education.
P3b: Edutainment messages can have positive effects concerning attitudes towards science on people with a lower education in comparison to people with a higher education.

The aspect of gender will also be evaluated, as it was shown that girls score the same results in science examinations, still they do not choose a career in science as often as male students do.

Q4: Which effects has Edutainment on people in relation to gender?

Proposition 4: Edutainment messages can have positive effects on females in comparison to males.

P4a: Edutainment messages can have positive effects concerning knowledge of science on females in comparison to males.
P4b: Edutainment messages can have positive effects concerning attitudes towards science on females in comparison to males.

6.2. Methodological approach

In order to reach the aim of closing this particular research gap, the hierarchy-of-effects model (McGuire, 1989) will serve as a basis for this empirical study. The source of the messages being investigated will be a broadcasting station, which uses the channel of television or internet to transmit an entertainment or education strategy. Television and internet programmes are selected as they are the most popular leisure activities of people in Austria. The message itself will centre both on the role of science in general as well as on a certain scientific topic.

6.2.1. Experimental survey

Participants will be exposed to a television (and internet) programme during an experimental setting. After that, they will be asked to fill out a questionnaire. The method that is applied here is an experimental survey.

An experiment is a method to test hypotheses that are already theoretically determined. One condition is that there has to be a high control of the social situation when an experiment is carried out. This does not mean that the social reality itself is being manipulated, it rather means to manipulate variables. An advantage of this empirical method is that test

subjects and test objects can be observed in an artificial setting and therefore social causalities are being constructed. Within this setting, hypotheses can be tested under rigorous testing conditions (Atteslander, 2003:196). An experiment can be defined as a means to proof a hypothesis, which tries to combine two factors in a causal relationship while examining them in different situations (Greenwood, 1972:177).

With an experimental setting, a systematic monitoring process is established where the phenomenon of interest is artificially created and varied (manipulation). At the same time, unsystematic sources of disturbances are eliminated or controlled (control). It is evaluated whether a condition established by the scientist leads to an expected outcome as a reaction Y in relation to X. If this is the case, one can assume a certain degree of plausibility that Y is a sufficient condition for X (Sarris/Reiß, 2005:30).

In the course of this master's thesis, participants will be asked to watch a predetermined television (or internet) programme at their home and are asked to watch it without distractions (mobile phones, etc.) but as "naturally" as possible. The investigator systematically manipulates the course of an investigation, making the changes in the dependent variable measurable that happened because of the direct or indirect manipulation of the independent variable (Zimmermann, 1972:37). The change can therefore be traced back to the experimental treatment (Sarris/Reiß, 2005:36f.).

In this master's thesis, the independent variable will be the stimulus material (chapter 6.3.) that will be shown to the participants. The dependent variable will be the reactions of the test persons, as in their knowledge gain and attitude towards science. By manipulating the stimulus material – as in showing two different formats with the same scientific topic – this will lead to different outcomes of knowledge increase and/or positive attitudes.

However, potential disturbance sources can occur which would influence the data in a systematic way. If this is the case, the change of data cannot be traced back to the relation between independent and dependent variable (Sarris/Reiß, 2005:36).

To carry out an experiment, Sarris/Reiß (2005:63f.) suggest to have an experimental design:

1. Before the experiment, hypothesis have to be formulated that contain presumptions about the causal dependence between an incidence and an outcome. This has already been done in chapter 6.1.
2. The experimental variables can be changed both quantitatively and qualitatively.
3. Expected disturbance sources are controlled. This will be controlled by observing participants while they are exposed to the programmes.

An ideal experimental design is present when all variables can be manipulated and all disturbance sources can be controlled. If not, the error probability is quite high and the internal validity is at risk. Internal validity is given when changes of the data can be traced

back specifically to the variation of the independent variable and not to characteristics of the participants (Sarris/Reiß, 2005:41).

6.3. Stimulus material

To examine the level of Edutainment in a television programme, as will be done in answering research question Q2, two different programmes will be selected. The first one is considered an education-only condition including news-style elements and the second one is an entertainment-only condition where an educational outcome is not the primary aim (Moyer-Gusé, 2007:41). Both programmes will feature the same scientific topic.
The chosen programmes will be described in more detail below. The same science content can be presented in different media, leading to questions about whether the format and structure of a medium influences learning outcomes (Bell et. al, 2009:273).
According to Carlson (2012:128), the literature generally talks about Edutainment in a dimension sphere, as in a mix between education and entertainment.

Figure 5 Spectrum of Edutainment (Carlson, 2012:128).

In contrast to thinking in one dimension, Edutainment can be comprehended as existing on a continuum. At one end is the concept of education which is purely attempting to teach information to a learner, and at the other end is the concept of entertainment, which is purely trying to engage or titillate an audience (Carlson, 2012:128). Carlson (2012:129) further elaborates that it is difficult to say exactly what ratio of each will produce the best instance of Edutainment. This thesis focuses exactly on this issue in an attempt to find the best possibility to educate learners.
Because of the unique ability of entertainment programming to involve and motivate viewers through their narrative and their characters in order to overcome reactance, as predicted by Social Cognitive Theory, the Extended Elaboration Likelihood Model and the Involvement-Resistance Model, it is expected that an Edutainment programme will be more effective in influencing attitudes, intentions, and behaviours than will a purely educational programme. Buckingham/Sefton-Green (2004:29) argue that non-educational programmes may lead to learning outcomes even though it is not produced for educational

purposes. Fisch (2004) also contrasted two categories with respect to presenting educational concepts: the documentary style and narrative formats. In the narrative format, scientific explanations are broken up and spread among multiple characters in contrast to the more didactic approach of the documentary format. A documentary format enables a direct explanation of scientific phenomena. In narratives, explanations need to occur in the course of conversations among characters.

The stimulus material is therefore chosen according to their presence or lack of narrative structure and characters that encourage transportation and involvement. To determine whether a narrative format is chosen that leads to involvement of the audience, it has to be analysed if a string of events connected by cause and effect is present, as well as a three-act structure containing a disruption of a stable situation, a double chronology, and the depiction of characters with traits that perform actions (Mason, 2005). The occurrence of characters will be analysed in accordance to their potential of identification, wishful identification, similarity, parasocial interaction, and liking (Moyer-Gusé, 2008).

6.3.1. Sitcom

6.3.1.1. What is a sitcom?

The "Big Bang Theory", as an American sitcom with a high percentage of entertainment, does not have the prior aim to educate its audience. It is a contemporary sitcom about two young physicists, Sheldon Cooper and Leonard Hofstadter, their scientists-friends Howard Wolowitz and Raj Koothrappali, and their new neighbour Penny, a pretty blonde girl who wants to be an actress but works as a waitress instead. The sitcom has been highly successful both in terms of industry awards and audience figures (Bednarek, 2012:202). It was created by Chuck Lorry and Bill Prady and has been aired since 2007 on the US network CBS with twelve seasons up to date. The series is available on "Pro Sieben" and "ORF 1" in Austria.

Every episode deals with a field of interest of the "nerds". The set and all the props are designed to reflect their lives as nerds. The main conflict of the show centres on the relationship between the scientists and "normal" people like Penny. One important aspect of the show is the use of dialogues that reflect the interests of scientists and their private obsessions with comics, movies, and costumes. In addition, many references to scientific themes are made, like the name-dropping of Stephen Hawking, Einstein, Marie Curie, etc. Nevertheless, the audience does not need any previous scientific knowledge to understand the humour of the show (Paier, 2014:75fff.) The scientists speak in long and complex

phrases, with foreign and technical words. The audience cannot always follow their statements, except that they are endued with deeper knowledge of physics. However, it is not necessary to understand all these concepts, as the joke consists in the inability to understand their messages. Penny serves therefore as a translator for the audience (Paier, 2014:94). To ensure that these statements and actions concerning science are displayed correctly, Dr. David Salzberg, a professor of physics and astronomy at the University of California (UCLA), serves an adviser to the show. He checks scripts and meets with producers, writers, and actors, etc. in order to ensure scientific accuracy. In addition, he started a blog called "The Big Blog Theory" that provides in depth-explanation of each episode's scientific matters. Moreover, Salzberg is responsible for scribbling formulas on all the whiteboards in the show (Beahm, 2014:220). As the series develops, female scientists were integrated into the show as the scientist's girlfriends. Amy Farrah Fowler is a neuroscientist and Bernadette Rostenkowski is a microbiologist, who introduce the audience to female intellectual experiences. Leslie Winkle is another character who serves as an equivalent to the male characters (Matton D'Amore, 2014:197).

6.3.1.2. Narrative of a sitcom

With regard to the narrative of a sitcom, it is a programme with a storyline continued from episode to episode (Huisman, 2005:154). A key element in sitcoms is the reoccurrence of numerous elements such as characters, places, gestures, discussions, topic, etc. (Kunert, 2012:30). There is a constant change of storylines and sometimes even figures but all within the familiar parameters. Viewers expect the series to continue and tell them different yet similar stories. At the same time, viewers expect a solution of the conflicts presented in an episode at the end of it (Hickethier, 1994).

The vast majority of sitcoms include the stages of equilibrium, disruption, resolution, and again equilibrium. Generally, they are characterised by a circular narrative structure, as the equilibrium at the end of each episode is exactly the same as it was at the beginning. In a sitcom, the humour revolves around a problem, the complication of this problem and its resolution. Sitcoms follow a very clear three-act structure that involves a beginning, a middle part, and an ending (Todorov, 1977). There is usually a setup, a problem that occurs, followed by complications and escalations. The characters plan what to do while the conflict gets bigger before they execute the plan. Finally, the situation gets resolved in the end, and the characters learn a lesson about life (Carter, 2001).

Sitcoms are characterised by indirect access. Although the camera always seems to be in the right place at the right time, the characters don't seem to know that it is there, since they never look at it or towards the viewers. It is a relatively self-enclosed world, with its

invisible "fourth wall" for the audience to peek inside. This world of story action is called diegesis and is a basic principle of narrative fiction (Budd/Craig/Steinman, 2004:93).

There are two types of timelines in a sitcom: the utterative and the enunciative time, meaning the absolute temporal placement and the duration and relative placement of events. This can be seen within each episode and in the relationships between episodes. Days- or weeks-long ellipses occur regularly, usually revealed by the discourse of characters. Consequently, the span of narrated time does not correspond to the time span of the sitcom's original airing (Savorelli, 2010:95).

With regard to Mason's (2005) characteristics of a narrative, it can be stated that "The Big Bang Theory" meets these criteria and does have in fact narrative structures to allow narrative involvement.

6.3.1.3. Characters in a sitcom

The narrative of a sitcom is usually generated by the nature of the characters, making involvement possible (Huisman, 2005:178). It is actually the characters who tell the stories on television. Analysis of science on television needs to attend to viewers' perception of who the scientist characters are (Dhingra, 2003:237).

A primary characteristic of narratives are the dramatis personae, as in the characters who populate the drama. Most characters are protagonists. In the case of "The Big Bang Theory", that would include the nerdy university scientists Sheldon Cooper, Leonard Hofstadter, Howard Wolowitz and Rajesh Koothrappali and their friend Penny. More recent episodes have added additional female protagonists including scientists Amy Farrah Fowler and Bernadette Rostenkowski. In general terms, storylines include an antagonist, who usually attempts to lead the heroes astray. "The Big Bang Theory" offers a few adversaries such as rival scientist Barry Kripke, university president Siebert or Star Trek actor Wil Wheaton. In addition, narratives are often accompanied by a cast of supporting players, such as Sheldon's mom, Penny's dad, Raj's parents, or Stuart, who owns the local comic book shop (Sellnow, 2014:99).

Identification with television characters is especially true for viewers who watch serials (soaps) and series (sitcoms and the like) over longer periods of time. Television characters mediate the different effects of television through processes such as identification, imitation, role modelling and parasocial interaction. Relationships between viewers and television characters can become quite intense over the years, as audiences may identify with a particular character. Identification with television characters and their problems heighten our involvement with them and contribute to the pleasure we derive from watching televi-

sion (Fourie, 2001:259). Horton and Wohl (1956) observed that television viewers commonly form personal bonds with sitcom characters, and even a parasocial relationship. Research evidence suggests that the characters that populate the programmes play a key role in generating and maintaining audiences (Hoffner/Cantor, 1991). The presence of likable, intriguing characters is consequently a key component of a successful programme (Gitlin, 1983). Over time, viewers become familiar with characters on continuing series and often feel as though they know these individuals as well as they know their friends. The importance of characters to viewers frequently extends beyond the viewing situation. Audience members feel they have personal relationships with the characters and a desire to become like them in significant ways (Hoffner/Cantor, 1991). Viewers tend to feel similar to characters who are like themselves in terms of demographic characteristics such as gender, race, and age, as well as personal characteristics such as personality, behavioural tendencies, or life experiences (Appiah, 2001; Turner, 1993).

Perceived similarities seem to facilitate the desire to become more like a character by emulating the character's attitudes, appearance, behaviour, or other characteristics (Hoffner/Buchanan, 2005:328). Wishful identification is influenced by the manner in which characters are portrayed (Bandura, 1986). The information viewers receive about a character is scripted, designed specifically to produce a particular impression in an efficient manner. Perceived intelligence for example is a characteristic that is commonly used when forming impressions of others. Intelligence is associated with many positive characteristics, such as problem-solving ability, social competence, and achievement (Sternberg, 2000).

Carlson (2012:53) states that SAE programmes rely on their own regular characters as they are constructing rhetorical arguments to convince the audience members that the information, and also the show itself, is legitimate.

In conclusion, sitcoms present characters who are able to generate involvement with characters and make the concepts of identification, liking, similarity, and social interaction possible for audience members.

6.3.2. Scientific television programme

6.3.2.1. What is a scientific programme?

With the emergence of television, a number of scientists have experimented with using programmes to lecture or to teach and producers became interested in fields like physics, biology, astronomy, and chemistry as inspiration and content. The science content that

eventually appeared on television resulted from negotiations among executives and scientific experts, institutional administrators, television executives and directors, etc. In addition, the audience weighted in via their remote control (LaFollette, 2013:5f).

A rather broad definition of a scientific programme is one that is produced by specific science editors and deals with all areas of scientific work (Neumann, 2007:7). The content can vary from information about these sciences to the social, political or economic context of research, to practical application and information about new projects and discoveries (Peters, 1996:77f, in: Stolberg, 2012:12).

A television science programme wants to convey lifelong learning and supports the educational mandate of public broadcasting stations. The basic framework of these shows is to offer audiences opportunities to gain knowledge and background information in order to increase their personal value with these information. The goal of these TV programmes is to transport scientific findings and research to offer daily guidance (Milde, 2009:36f.). Science documentaries and science news want to acquaint viewers with the latest developments in different fields of science (Shamsher Ali, 2014:282). According to the Nielsen ratings, however, scientific educational programming is not reaching vast numbers of the population and are rather viewed by people who already have an interest in science (Whittle, 2012:9). The problem is that these programmes have to convey complicated topics to mass audiences and, at the same time, have to be informative and appealing (Hömberg/Yankers, 2000:574).

A possibility to avoid that can be entertainment. When it comes to entertainment, Mayer (2014:36) argues that television always has to have an entertaining component. In scientific programmes, entertainment does play a role but it should be rather subtle and unobtrusive. Possibilities to do so are the selection of the topic and the visual or verbal realisation of that topic. Strategies can be to implement emotional content, or apply dynamism, and narrative structures (Mayer, 2014:37f.).

The German scientific programme "Terra x Lesch & Co" is produced by ZDF, a public service broadcasting station. The programme, that is also broadcasted on YouTube, will be selected as the second stimulus material as the documentary format.

6.3.2.2. Narrative in a scientific programme

Ruß-Mohl (1987:13f.) notes that telling a story is a possibility to give an audience an understanding of the world of science and, specifically, of a rather difficult and complex topic. Storytelling often has negative connotations within science. However, as narratives often increase comprehension, interest, and engagement, non-expert audiences would profit from narrative structures in science television magazines. Narratives are also intrinsically

persuasive, which offers science communicators opportunities to persuade resistant audiences. They follow a particular structure that describes the cause-and-effect relationships between events that take place over a particular period of time and impacts particular characters. Causality, temporality, and characters are generally part of the narrative communication. This definition is independent of content, which means that narratives can be present within almost every communication activity. However, narratives often contrast the logical-scientific communication underlying most of the science television programmes (Dahlstrom, 2014:13614).

In television magazines, logical-scientific communication aims to provide abstract truths that remain valid across a specified range of situations. An individual may then use these abstract truths to generalize down to a specific case and ideally provide some level of predictive power regarding that specific topic. Narrative communication, on the other hand, provides a specific case from which an individual can infer what the general truths must be to permit such a specific to occur. To sum that up, the utilization of logical-scientific information follows deductive reasoning, whereas the utilization of narrative information follows inductive reasoning (Dahlstrom, 2014:13614).

Implementing a narrative style can be tricky as science television magazines are often produced in an expository style that emphasises a sense of objectivity, epistemic knowledge, and a logical, cause/effect sequencing of events which can be supported by an authoritative voice-over narration (Nichols, 1991:34). Expository documentaries pose clear questions and provide definite answers. Interviews are strategically placed within the text (Plantinga, 1997:110).

Moreover, logical-scientific communication is context-free. The understanding of facts does not depend on the surrounding of information. These facts remain meaningful and can be excised from the programme itself and still make sense. In contrast, narrative communication is context-dependent because it derives its meaning from the ongoing cause-and-effect structure of the temporal events of which it is comprised. It is more difficult to understand the certain topic without its surrounding (Dahlstrom, 2014:13614f.).

Logical-scientific communication wants to provide general truths as an outcome. The legitimacy of its message is judged on the accuracy of its claims. Narrative communication on the other hand aims to provide a reasonable depiction of individual experiences. The legitimacy of its message is judged on the verisimilitude of its situation (Dahlstrom, 2014:13615).

Development needs to take place in any television programme, as it has to unravel or unfold events and make links between them. However, development alone is not engaging. As of the device of disruption and conflict, the backbone of a story structure, a docu-

mentary-style programme is generally not driven by conflict. When it comes to the chronology of such a television programme, the tendency is to follow people or events through time and let it all happen as it were, which may not create sufficient tension in the programme (De Jong, 2011:98fff.).

Another element of a narrative is the three-act structure. In sciences television programmes, however, the structure contains an introducing statement or thesis and the rest of the programme explores the different aspects of the topic. It may finish with a conclusion, but it could also end with a question or a provocative statement that challenges the perception of an audience (De Jong, 2011:106). As Mayeri (2008:64) puts it, a scientific programme in particular is shaped by an essay-like structure. It opens with one particular question, statement or thesis and finishes with an argument or answer to the question, like a written essay (De Jong, 2011:107). We can therefore assume that science television magazines rather rely on exposition than on narrative (Nichols, 1991:142).

These differences show that logical-scientific and narrative communication are not only contrasting formats of communication, but also represent two distinct cognitive pathways of comprehension. The paradigmatic pathway controls the encoding of science-based evidence, and the narrative pathway controls the encoding of situation-based formats. Empirical studies suggest that narrative processing is generally more efficient. Narratives are often associated with increased recall and easier comprehension. The intrinsic benefits of comprehension of narrative communication could benefit the communication of science (Dahlstrom, 2014:13615).

6.3.2.3. Characters in a scientific programme

People's acceptance of scientific information depends on how it is presented to them. The success of a television programme dealing with a complicated topic relies to a large extent on the art of presentation. However, scientists are usually not very adept in this. Presenters have to be appreciated for their depth of knowledge (Shamsher Ali, 2014:282f.). Making use of "people" in scientific programmes can lighten up the whole presentation and transmit authenticity (Bischl, 1997:109).

For an audience to have an entertainment experience, it is essential that they have affinity with the characters and an ability to relate to them. If non-fictional genres want to attract audiences, they have to follow that rules, too. It is important for an audience's acceptance of characters that the presenter is someone they can relate to (Vorderer et al., 2004:395ff.). Communicators on scientific programmes would also need to apply emotional stimuli to attract audiences in entertaining ways (Mayer, 2014:41).

However, that is rather difficult as documentary-style programmes rely heavily on the spoken word. Commentary in scientific programmes can be provided by voiceover narrators, reporters, interviewees, and other actors (Nichols, 1991:21).

Scientists or professional actors explain a scientific topic, perhaps re-enacting the story of its invention, and speculating about its significance and future (Mayeri, 2008:64). Real scientists have been recruited as high profile presenters of science programmes, as this brings credulity, credibility, and authority to the programme. Those presenters engender trust in their audience and promotes belief and acceptance of the subject matter being conveyed. Because they are experts in their subject, they are passionate about it and they are able to convey complex ideas in a straightforward and accessible way (Bowater/Yeoman, 2013). Hosts have great responsibilities and influence, however, these TV presenters are often entirely unrepresentative of the demographics of the viewing population. A study conducted in the US, UK, and Germany showed that most of these presenters are white and part of the country's dominant culture. Males comprised 71 % of all presenters, while females accounted for only 29 % (Holler et al., 2016:498). Moreover, scientists are generally portrayed as good but also strange characters (Dudo, et al., 2011:755).

A programme in an expository mode will expound on a topic, with the narrator's script acting as the main means via which information is selected, shaped, and passed on to the viewer. The script is considered to be the primary organiser of meaning as it lays out the argument or story which the images themselves often only confirm (Kilborn/Izod, 1997:59). In an expository documentary, a voice-over is often used, described as the "voice of God". This voice addresses social issues or explains certain phenomena in our world, delivering the truth of the matter. It is anonymous - a voice from nowhere - but tends to belong to a male, white, middle-class individual that can be identified as part of the establishment (De Jong, 2011:101).

While in other formats stories are character-driven, documentaries and other scientific programmes run some risk of credibility in re-enacting an event (Nichols, 1991:21). However, the knowledge that the presenter in a documentary format has exists beyond the film – unlike the characters of fiction – which may lead to emotional involvement. Nevertheless, audience members' feelings are always leavened by the knowledge that they are being addressed directly, and they can feel that documentary subjects are appealing to them to respond in a fairly explicit way (Ellis, 2012).

The scientists who are characters in a narrative are allowed their distance and rationality while an additional character, the narrator, is allowed to enhance the dramatic effect of the story through the use of rhetorical devices, e.g. tempo, conflict, paralanguage, etc. that might undermine the experts performing field work (Carlson, 2012:64).

The character who is occurring on Terra X Lesch & Co, is called Harald Lesch. He acts as a presenter and voiceover narrator. His performance will be analysed in accordance to his potential of identification, wishful identification, similarity, parasocial interaction, and liking (Moyer-Gusé, 2008).

Harald Lesch is a German professor of Theoretical Astrophysics and has worked for numerous television programmes – "Alpha centauri", "Die Physik Albert Einsteins", "Lesch & Co", "Denker des Abendlandes", "Alpha bis Omega", "Leschs Kosmos", and so on. Since February 2016, he works on "Terra X Lesch & Co" together with Philip Häusser" (ZDF, 2016). He also published many popular scientific books like "Kosmologie für Fußgänger" (2001), "Big Bang, zweiter Akt. Auf den Spuren des Lebens im All" (2003), "Kosmologie für helle Köpfe. Die dunklen Seiten des Universums" (2006), etc. (Lesch, 2017).

6.4. Scientific topic

The scientific topic that is selected for this master's thesis is Schroedinger's Cat, which is both explained in the Big Bang Theory and Terra X Lesch & Co.

Erwin Schrödinger, an Austrian scientist, was one of the first to deal with quantum mechanics, the foundation of modern natural science. His equations describe the behaviour of really small objects, as small or smaller as atoms. Without these equations, there wouldn't be any nuclear power plants, no microbiology, or no understanding of DNA, for example. However, quantum mechanics is rather strange, to say the least. It postulates that nothing is real and that we cannot say anything about the behaviour of things that we cannot observe. The thought experiment of Schroedinger's Cat serves as a means to highlight the difference between the normal world and the world of quantum mechanics. Here, physical laws are not valid anymore. Occurrences are rather described in probabilities (Gribbin, 2011). The dilemma of Schroedinger's Cat, in short, is about a cat enclosed in a box and finding itself dead and alive at the same time until the box is opened (Rowlands, 2015:1).

> *"A cat is penned up in a steel chamber, along with the following device (which must be secured against direct interference by the cat): in a Geiger counter there is a tiny bit of radioactive substance, so small, that perhaps in the course of the hour one of the atoms decays, but also, with equal probability, perhaps none; if it happens, the counter tube discharges and through a relay releases a hammer which shatters a small flask of hydrocyanic acid. If one has left this entire system to itself for an hour, one would say that the cat still lives if meanwhile no atom has decayed. The psi-function of the entire system would express this by having in it the loving and dead cat (pardon the expression) mixed or smeared out in equal parts."* (Schrödinger, in: Rowlands, 2015:55f.).

In short, this thought experiment describes the problem of measuring in quantum physics, as in the occurring entanglement of two atomic individual systems into one entire system. When separated again into their original systems, information is being lost. This process of entanglement leads to a certain non-locality in quantum physics, which is unknown in classical physics. This non-locality has been experimentally proven in quantum physics (Steinhauser, 2017:569).

In The Big Bang Theory, the dilemma of Schroedinger's Cat is explained as followed:

> *„1935 hat Erwin Schrödinger bei dem Versuch die Kopenhagener Deutung der Quantenphysik zu erklären, ein Experiment vorgeschlagen, bei dem eine Katze in eine Kiste gesperrt wird, zusammen mit einer versiegelten Giftampulle, die irgendwann zerbrechen würde. Gut, da niemand weiß, wann oder ob das Gift freigesetzt wurde, bevor die Kiste geöffnet wird, kann die Katze gleichzeitig als beiden angesehen werden, lebendig und tot. [...]Genau wie bei Schrödingers Katze kann deine mögliche Beziehung mit Leonard gerade jetzt als beides angesehen werden, als gut und ebenso als schlecht. Erst durch das Öffnen der Kiste wirst du herausfinden, was zutrifft."* („Schrödingers Katze", 2009: 15:12-16:04).

In Terra X Lesch & Co, the same scientific topic is discussed by the TV show host Harald Lesch:

> *„Ich habe heute einen Gast, oder eine Gästin, das weiß ich gar nicht so genau. Eine der berühmtesten Katzen der Welt. Die Katze von Erwin Schrödinger. Die Frage ist: Lebt sie noch? Ist sie schon tot? Oder ist sie immer noch in dem Bereich irgendwo dazwischen? Ja hier, ich mach sie gleich auf, komm, ich mach es kurz und bündig. Erwin Schrödinger, großer Physiker, einer der Begründer der Quantenmechanik, hatte sich vor etlichen Jahrzehnten folgende Gedanken gemacht. Wenn ich in so einem Kasten ein radioaktives Element drinnen hätte, also ein radioaktives chemisches Element, das kann zerfallen, und durch den Zerfall wird ein Hammer dazu veranlasst werden, eine Phiole mit Gift zu zertrümmern. Und die Katze, die hier in dem Kasten ist, die würde dann eben entsprechend sterben. Das Finale wäre auf jeden Fall, wenn ich nur lang genug warte, dass die Katze tot ist. Aber in welchem Zustand ist die Katze? [....]"* ("Schrödingers Katze, Tot oder lebendig?" 2018: 00:00-01:02)

7. Results

The following chapter will display the findings of the experiment carried out. In the chapter "Discussion", these findings will be interpreted and analysed. The calculations were done with the statistics programme "PSPP".

One item of the questionnaire dealt with the profession of the participants. This was done to eliminate all data from people with a scientific background in physics or quantum mechanics that could have had an effect on prior knowledge and understanding of the scientific topic. Out of 140 participants, 7 were excluded because of their scientific profession. The sample therefore consisted of 133 participants of all ages (+12) and living in Austria.

7.1. Proposition 1: Edutainment and effects

The first research question was concerned with the effects experienced when exposed to an Edutainment programme. These effects were contrasted with the ones that were the result of a scientific programme. The effects investigated, in accordance with the literature review, were the concepts of knowledge and attitudes towards science.

7.1.1. Proposition 1a: Edutainment and knowledge

P1a: When exposed to an Edutainment programme, viewers will gain knowledge about the topic presented.

First, it shall be evaluated if viewers gained knowledge about the scientific topic. Knowledge was measured with a question about the viewers' recollection of the topic, two recall questions, sparked interest, and personal relevance.
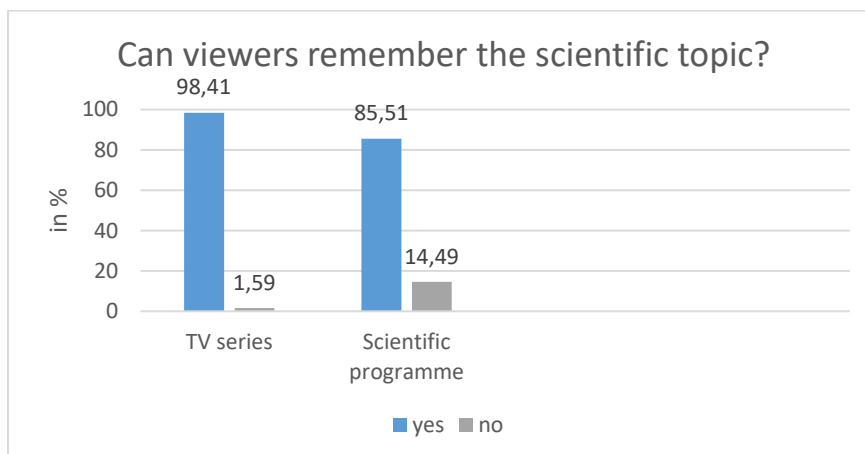
The majority of people who watched the TV series could remember that the topic was part of the show (98.41 %), while only 1.59 % didn't remember it at all. On the other hand, 85.51 % who watched the scientific programme stated that they have recollection of it, 14.49 % did not. In general, 90.98 % of the total sample had recollection of the topic being presented (121 out of 133 participants).

A t-test was conducted to find out about the significance of this finding. In this case, the mean of the TV series was 1.02 and of the scientific programme it was 1.14 (1 = yes, 2 = no). This suggests that slightly more people remember the scientific topic when watching the episode of the TV series. The difference between the means of the two types of programmes is significant with a p-value of 0.007.

Gruppenstatistiken

	Fragebogentyp	N	Mittelwert	Std. Abweichung	Standardfehler des Mittelwertes
Erinnerung	Serie	63	1,02	,13	,02
	Dokumentation	69	1,14	,35	,04

Test bei unabhängigen Stichproben

|		Levene-Test der Varianzgleichheit		T-Test für die Mittelwertgleichheit					95% Konfidenzintervall der Differenz	
		F	Sig.	t	df	Sig. (2-seitig)	Mittlere Differenz	Stdfehler der Differenz	Untere	Obere
Erinnerung	Varianzen sind gleich	38,37	,000	-2,73	130,00	,007	-,13	,05	-,22	-,04
	Varianzen sind nicht gleich			-2,83	86,29	,006	-,13	,05	-,22	-,04

The next item was concerned with the recall of information regarding the scientific topic. Participants were asked to write down as many facts as possible with regard to Schroedinger's Cat. For that reason, a transcript of both programmes (see appendices) was carried out to categorise facts that could have been remembered. The answers of the participants were put into categories of "nothing remembered", "1-3 facts remembered", "4-6 facts remembered", and "7 and more facts remembered". Originally, the recall item consisted of another question concerning "other scientific facts" remembered. However, this question was kicked out of this statistical calculation as there were a lot more other scientific facts mentioned in the scientific programme as in "The Big Bang Theory", which would not have been fair to evaluate and would not have been easy to compare.
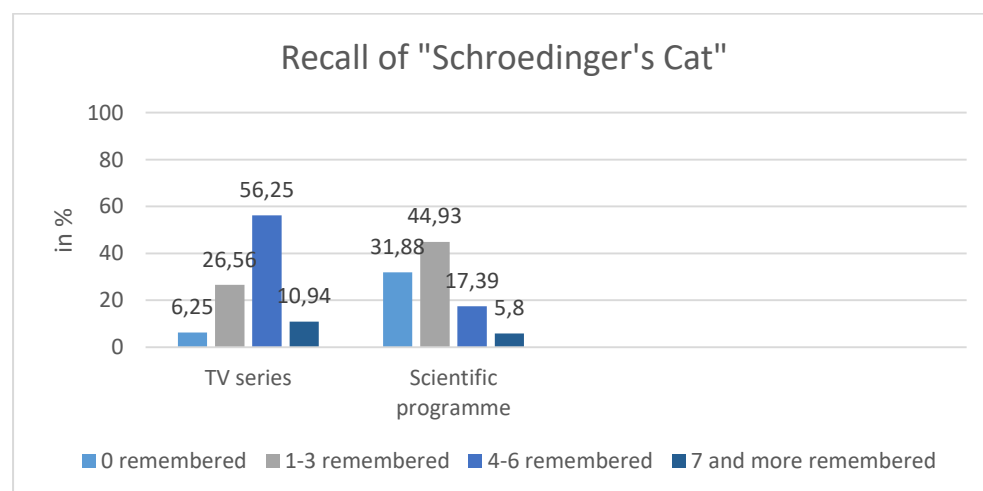
The figure shows that more than half of the TV series viewers could remember 4 to 6 facts while people watching the scientific programme could mostly identify 1-3 facts (44.93 %). With regard to the TV series, only 6.25 % couldn't name any facts while 31.88 % of the viewers of the scientific programme could not remember anything.

The mean of the TV series is 2.72 and of the scientific programme is 1.97 (scale of 1-5). The difference of these two means is highly significant with a p-value of 0.000.

Gruppenstatistiken

	Fragebogentyp	N	Mittelwert	Std. Abweichung	Standardfehler des Mittelwertes
Abruf Schrödingers Katze	Serie	64	2,72	,74	,09
	Dokumentation	69	1,97	,86	,10

Test bei unabhängigen Stichproben

		Levene-Test der Varianzgleichheit		T-Test für die Mittelwertgleichheit						95% Konfidenzintervall der Differenz	
		F	Sig.	t	df	Sig. (2-seitig)	Mittlere Differenz	Stdfehler der Differenz		Untere	Obere
Abruf Schrödingers Katze	Varianzen sind gleich	,06	,804	5,35	131,00	,000	,75	,14		,47	1,02
	Varianzen sind nicht gleich			5,38	130,46	,000	,75	,14		,47	1,02

The next step was to investigate if the scientific topic sparked any interest in the viewers.
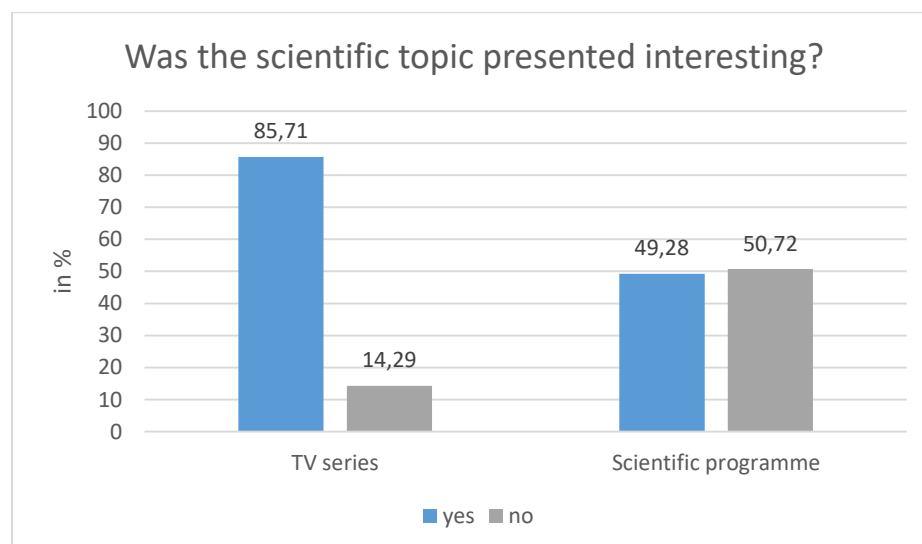
The topic in general sparked a lot of interest in the viewers (66.67 % of the total sample). However, more viewers (85.71 %) of the TV series said that they found Schroedinger's Cat interesting. Half of the viewers of the scientific programme thought that the topic was interesting. The t-test showed that the mean of the TV series was 1.14 and the mean of the scientific programme was 1.51 (1 = yes, 2 = no). The difference between these two mean values is significant (p-value = 0.000).

Gruppenstatistiken

	Fragebogentyp	N	Mittelwert	Std. Abweichung	Standardfehler des Mittelwertes
Gedankenexperiment interessant?	Serie	63	1,14	,35	,04
	Dokumentation	69	1,51	,50	,06

Test bei unabhängigen Stichproben

		Levene-Test der Varianzgleichheit		T-Test für die Mittelwertgleichheit						95% Konfidenzintervall der Differenz	
		F	Sig.	t	df	Sig. (2-seitig)	Mittlere Differenz	Stdfehler der Differenz		Untere	Obere
Gedankenexperiment interessant?	Varianzen sind gleich	70,66	,000	-4,77	130,00	,000	-,36	,08		-,52	-,21
	Varianzen sind nicht gleich			-4,85	122,06	,000	-,36	,08		-,51	-,22

The next question was directed at the personal relevance of the scientific topic for the viewers.
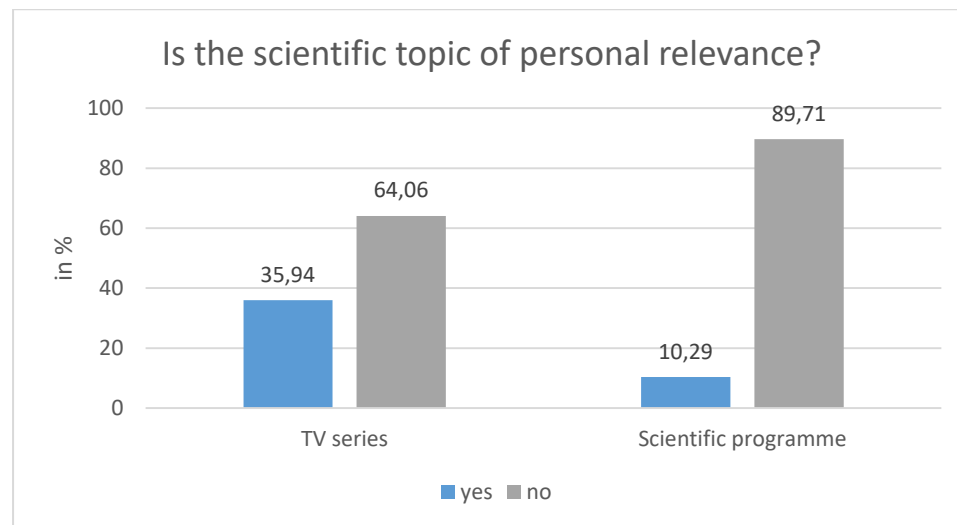
In general, people thought that the scientific topic was not relevant for them (77.27 %). However, more watchers of the TV series (35.94 %) have seen a personal relevance for them, in comparison to 10.29 % of participants who watched the scientific programme. The t-test shows that the mean of the TV series is 1.64 and of the scientific programme is 1.90 (1 = yes, 2 = no). A high significance of this difference is given with a p-value of 0.000. This means that participants that watched the TV series are more likely to find the topic relevant for them.

Gruppenstatistiken

	Fragebogentyp	N	Mittelwert	Std. Abweichung	Standardfehler des Mittelwertes
Gedankenexperiment persönlich relevant?	Serie	64	1,64	,48	,06
	Dokumentation	68	1,90	,31	,04

Test bei unabhängigen Stichproben

		Levene-Test der Varianzgleichheit		T-Test für die Mittelwertgleichheit						95% Konfidenzintervall der Differenz	
		F	Sig.	t	df	Sig. (2-seitig)	Mittlere Differenz	Stdfehler der Differenz		Untere	Obere
Gedankenexperiment persönlich relevant?	Varianzen sind gleich	63,59	,000	-3,66	130,00	,000	-,26	,07		-,39	-,12
	Varianzen sind nicht gleich			-3,61	105,39	,000	-,26	,07		-,40	-,12

Furthermore, it is interesting to notice that recalling Schroedinger's Cat correlates positively with interest (+0.35 / 0.000). This means that the more people can remember about the scientific topic, the more they find it interesting. Also, finding the concept interesting correlates positively with personal relevance (+0.35 / 0.000). This means that the more interesting viewers find the topic, the more relevant it seems to them.

The last question concerning knowledge was installed to see if people think that they have understood the topic and if it can be linked to the viewer's prior exposure to it.

Prior knowledge of the scientific topic?
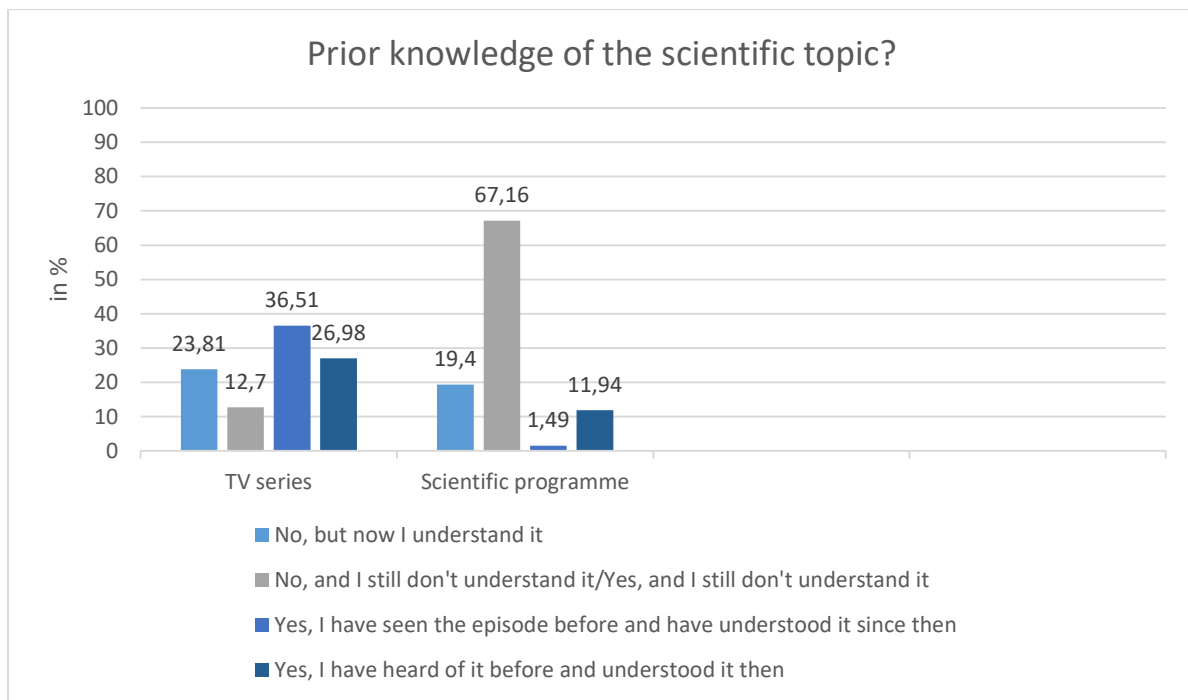
The majority of the watchers of the TV series believe to understand the scientific topic because of the exposure to the programme (60.32 % in total). Viewers of the scientific programme mostly still felt that they do not know what Schroedinger's Cat is about (67.16 %).

Chi-Quadrat Tests.

Statistik	Wert	df	Asymp. Sig. (2-seitig)
Pearson Chi-Quadrat	49,30	3	,000
Likelihood-Quotient	56,78	3	,000
Zusammenhangstest linear-mit-linear	11,37	1	,001
N der gültigen Fälle	130		

The Pearson Chi square test shows that this distribution is highly significant with a value of 0.000.

In summary, viewers of the TV series had more recollection of the scientific topic, they remembered more facts about it, and they thought it to be more interesting and relevant for them personally.

7.1.2. Proposition 1b: Edutainment and attitude

P1b: When exposed to an Edutainment programme, viewers will form a more positive attitude towards the scientific topic than viewers of a scientific programme.

The second part of this research question is concerned with a positive attitude towards science because of an exposure to the Edutainment programme. The 25 items of the attitude scale from Johnston (1997) were transformed into one variable. To see if that is possible, a reliability analysis was carried out. The Cronbach's Alpha was 0.8 which means that reliability is given.

Zusammenfassung der Fallverarbeitung

		N	%
Fälle	Gültig	125	93,98
	Ausgeschlossen	8	6,02
	Gesamt	133	100,00

Reliabilitätsstatistiken

Cronbach's Alpha	N der Items
,80	25

It is now of interest if the attitude towards science is more positive after watching the TV series or the scientific programme. The TV series scored a mean of 3.77 and the scientific programme 3.55 (out of 5). The significance of the mean difference is given with a p-value of 0.002, according to a t-test. The general mean value of the attitude towards science is 3.66 (out of 5).
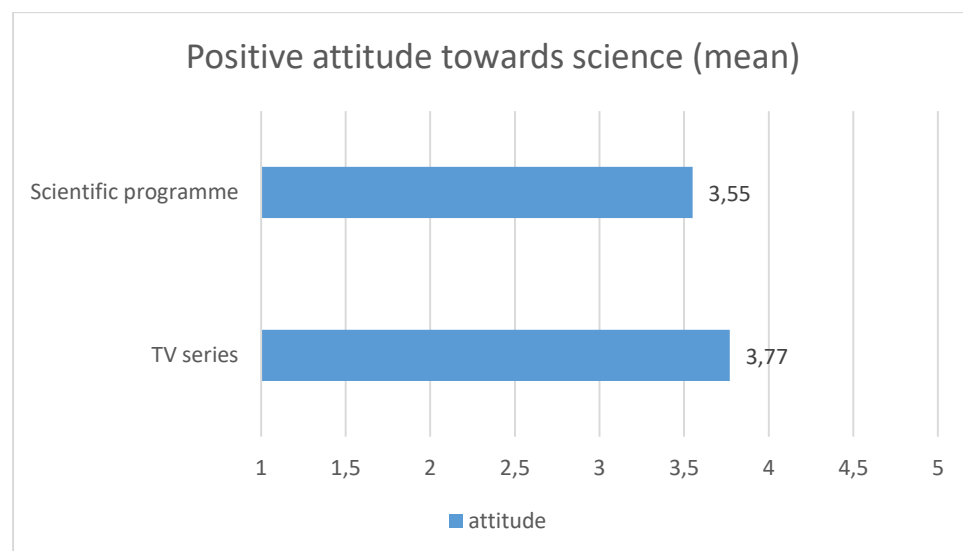
Gruppenstatistiken

	Fragebogentyp	N	Mittelwert	Std. Abweichung	Standardfehler des Mittelwertes
Einstellung Mittelwert Zusammenfassung	Serie	63	3,77	,37	,05
	Dokumentation	69	3,55	,40	,05

Test bei unabhängigen Stichproben

		Levene-Test der Varianzgleichheit		T-Test für die Mittelwertgleichheit					95% Konfidenzintervall der Differenz	
		F	Sig.	t	df	Sig. (2-seitig)	Mittlere Differenz	Stdfehler der Differenz	Untere	Obere
Einstellung Mittelwert Zusammenfassung	Varianzen sind gleich	,01	,915	3,19	130,00	,002	,22	,07	,08	,35
	Varianzen sind nicht gleich			3,20	129,98	,002	,22	,07	,08	,35

Also, when looking at the summarised variable "attitude", the TV series scored a mean value of 94.25 and the scientific programme scored 88.92. The significance of that correlation is 0.003.

Gruppenstatistiken

	Fragebogentyp	N	Mittelwert	Std. Abweichung	Standardfehler des Mittelwertes
Einstellung Index Zusammenfassung	Serie	61	94,25	9,36	1,20
	Dokumentation	64	88,92	10,39	1,30

Test bei unabhängigen Stichproben

		Levene-Test der Varianzgleichheit		T-Test für die Mittelwertgleichheit					95% Konfidenzintervall der Differenz	
		F	Sig.	t	df	Sig. (2-seitig)	Mittlere Differenz	Stdfehler der Differenz	Untere	Obere
Einstellung Index Zusammenfassung	Varianzen sind gleich	,05	,823	3,01	123,00	,003	5,32	1,77	1,82	8,83
	Varianzen sind nicht gleich			3,01	122,62	,003	5,32	1,77	1,83	8,82

It can therefore be stated that attitudes towards science were more positive after watching the episode of the TV series.

7.2. Proposition 2: Narrative/character involvement and effects

The second research question deals with the correlation between narrative and character involvement on the one hand, and knowledge and attitudes on the other. It will now be calculated if there are, in fact, correlations between these concepts.

In a first step, it will be evaluated if there is reliability when adding the items of Busselle/Bilandzic (2009) into one variable called "narrative engagement". A Cronbach's Alpha of 0.78 suggests that this is the case.

Zusammenfassung der Fallverarbeitung

		N	%
Fälle	Gültig	125	93,98
	Ausgeschlossen	8	6,02
	Gesamt	133	100,00

Reliabilitätsstatistiken

Cronbach's Alpha	N der Items
,78	12

When comparing narrative involvement with the two distinct programmes, it is displayed that the mean of the TV series is significantly (0.000) higher than the one of the scientific programme. This suggests that people watching the TV series were more immersed into the storyline of The Big Bang Theory.

Narrative involvement (mean)

	Narrative involvement
Scientific programme	2,6
TV series	3,08

■ Narrative involvement

Gruppenstatistiken
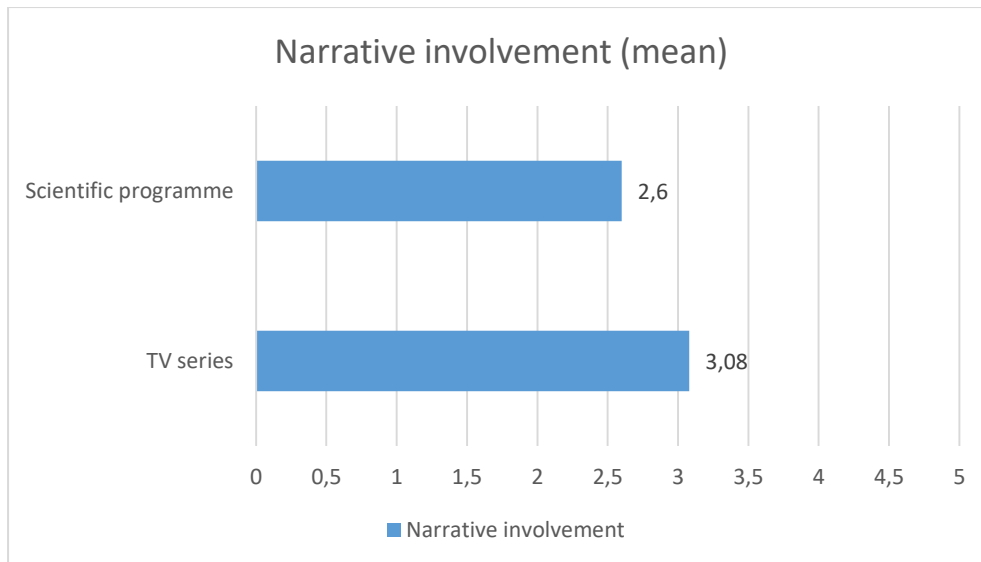
	Fragebogentyp	N	Mittelwert	Std. Abweichung	Standardfehler des Mittelwertes
NarrativeEngagement	Serie	62	3,08	,49	,06
	Dokumentation	69	2,60	,64	,08

Test bei unabhängigen Stichproben

		Levene-Test der Varianzgleichheit		T-Test für die Mittelwertgleichheit					95% Konfidenzintervall der Differenz	
		F	Sig.	t	df	Sig. (2-seitig)	Mittlere Differenz	Stdfehler der Differenz	Untere	Obere
NarrativeEngagement	Varianzen sind gleich	6,75	,010	4,70	129,00	,000	,47	,10	,27	,67
	Varianzen sind nicht gleich			4,77	125,79	,000	,47	,10	,28	,67

7.2.1. Proposition 2a: Narrative involvement and knowledge

P2a: The more involvement in narrative takes place, the more effects on knowledge gain.

When correlating narrative involvement (of both programmes) with knowledge items (recollection, recall, interest, and personal relevance), the Pearson correlation shows how items relate to one another.

Korrelationen

		Narrative Engagement	Erinnerung	Abruf Schrödingers Katze	Gedankenexperiment interessant?	Gedankenexperiment persönlich relevant?
Narrative Engagement	Pearson Korrelation	1,00	-,01	,24	,52	,33
	Sig. (2-seitig)		,913	,006	,000	,000
	N	132	131	132	131	131
Erinnerung	Pearson Korrelation	-,01	1,00	,30	,02	-,10
	Sig. (2-seitig)	,913		,000	,840	,238
	N	131	132	132	131	131
Abruf Schrödingers Katze	Pearson Korrelation	,24	,30	1,00	,35	,14
	Sig. (2-seitig)	,006	,000		,000	,111
	N	132	132	133	132	132
Gedankenexperiment interessant?	Pearson Korrelation	,52	,02	,35	1,00	,35
	Sig. (2-seitig)	,000	,840	,000		,000
	N	131	131	132	132	131
Gedankenexperiment persönlich relevant?	Pearson Korrelation	,33	-,10	,14	,35	1,00
	Sig. (2-seitig)	,000	,238	,111	,000	
	N	131	131	132	131	132

Recollection of the topic being presented does not correlate with narrative engagement at all. There is a light correlation between the recall of Schroedinger's Cat and narrative engagement (+0.24 with a significance of 0.006). This means that if there is more narrative engagement, the more facts are remembered about the topic (or the other way around).

Both interest and personal relevance show a positive correlation with narrative involvement (highly significant with 0.000). This shows that the more narrative engagement, the more interesting and relevant seems the scientific topic.

7.2.2. Proposition 2b: Narrative involvement and attitudes

The next effect that is investigated for this proposition is the correlation between narrative involvement and attitudes. The combined variables (means) of narrative engagement and attitudes have been used again. As we can see in the figure below, the Pearson correlation suggests a value of 0.30 with a significance of 0.001. This means that the more narrative engagement happens, the more positive the attitude towards science gets.

Korrelationen

		Narrative Engagement	Einstellung Mittelwert Zusammenfassung
Narrative Engagement	Pearson Korrelation	1,00	,30
	Sig. (2-seitig)		,001
	N	132	132
Einstellung Mittelwert Zusammenfassung	Pearson Korrelation	,30	1,00
	Sig. (2-seitig)	,001	
	N	132	133

Next, we will look at the propositions 2c and 2d which are concerned with character involvement and, again, with knowledge and attitudes towards science.

Character involvement was measured with the items of liking, wishful identification, similarity, and parasocial interaction. As these items were measured with different scales, they will be looked at individually. First, it will be evaluated if the TV series made more character involvement possible than the scientific programme, as proposed by the research literature.

Liking (mean)

Scientific programme: no 19,7 / yes 80,3
TV series: no 11,67 / yes 88,33

in %

no yes
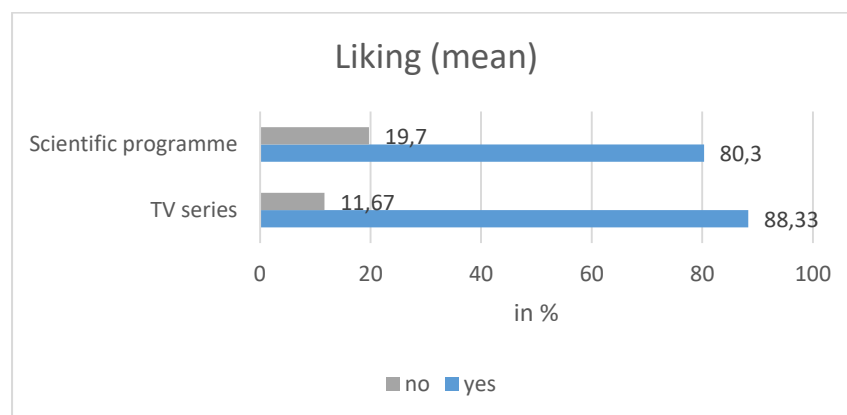
Generally, we can say that more people of the TV series found a (self-chosen) character likable (88.33 %), however, the difference between both programmes is quite low. A t-test also shows that there is no significance (0.221) between the differences of the means.

Gruppenstatistiken					
	Fragebogentyp	N	Mittelwert	Std. Abweichung	Standardfehler des Mittelwertes
Liking	Serie	60	1,88	,32	,04
	Dokumentation	66	1,80	,40	,05

Test bei unabhängigen Stichproben										
		Levene-Test der Varianzgleichheit		T-Test für die Mittelwertgleichheit					95% Konfidenzintervall der Differenz	
		F	Sig.	t	df	Sig. (2-seitig)	Mittlere Differenz	Stdfehler der Differenz	Untere	Obere
Liking	Varianzen sind gleich	6,34	,013	1,23	124,00	,221	,08	,07	-,05	,21
	Varianzen sind nicht gleich			1,24	122,35	,217	,08	,06	-,05	,21

Out of 133 participants, 106 liked the character and 20 did not (missing value = 7). Next, perceived similarity and both programmes were evaluated. First of all, a Cronbach's Alpha of 0.86 suggests that the items of similarity are reliable.

Reliabilitätsstatistiken

Cronbach's Alpha	N der Items
,86	8
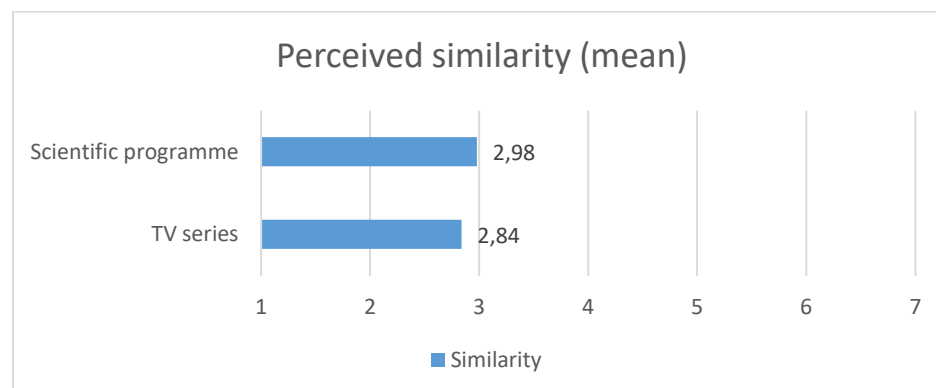
Secondly, the mean (1 = the character is not similar to me, 7 = the character is similar to me) of the scientific programme is higher than the one of the TV series. However, there is no significance (0.477). Next, wishful identification as part of character involvement will be looked at.

Reliabilitätsstatistiken

Cronbach's Alpha	N der Items
,73	5

A Cronbach's Alpha of 0.73 confirms reliability of this scale. The means show that more people watching the TV series experienced wishful identification. This difference between

the mean values is not significant with 0.088 but rather a trend. We can therefore say that viewers of the TV series tend to have more wishful identification with characters than the ones of the scientific programme.

Wishful identification (mean)

Scientific programme	2,38
TV series	2,6

Axis: 1, 1,5, 2, 2,5, 3, 3,5, 4, 4,5, 5

■ Wishful identification

Parasocial interaction (mean)

Scientific programme	2,76
TV series	3,26

Axis: 1, 1,5, 2, 2,5, 3, 3,5, 4, 4,5, 5

■ Parasocial interaction
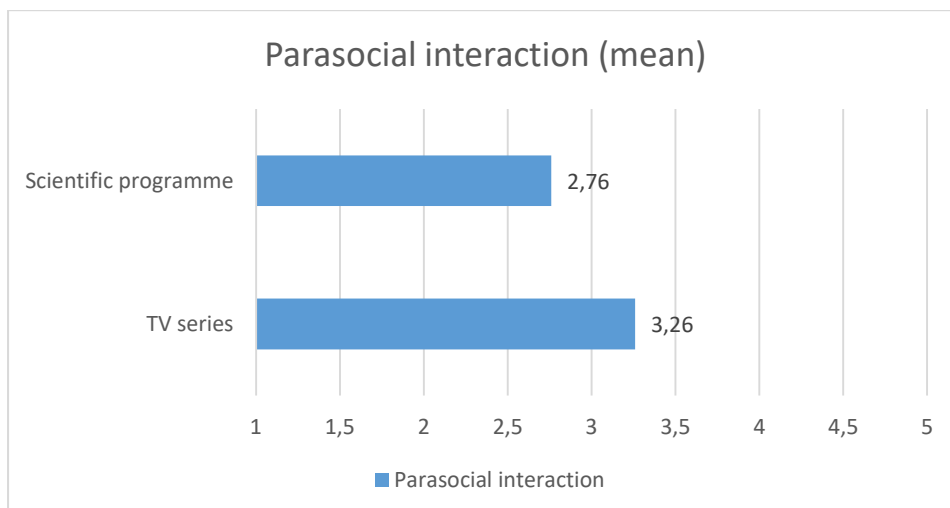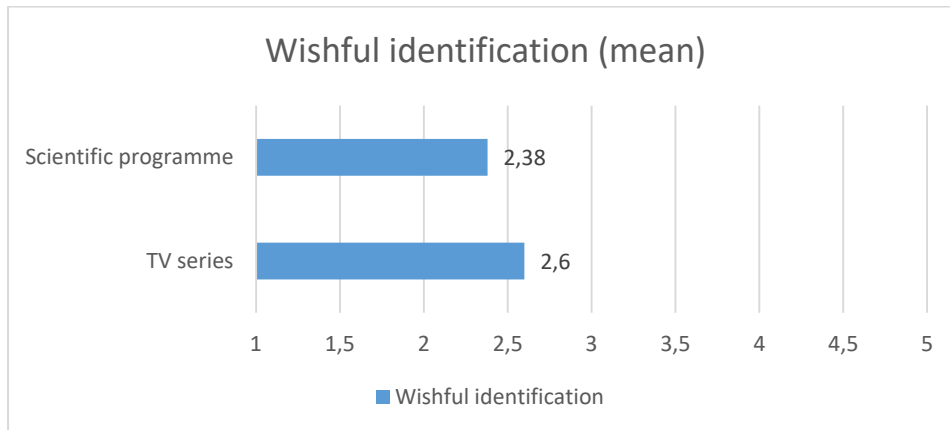
The reliability of the items measuring parasocial interaction with a Cronbach's Alpha of 0.78 is given. More watchers of the TV series had a parasocial relationship with the character(s) than the viewers of the scientific programme. A t-test suggests a very high significance of 0.000.
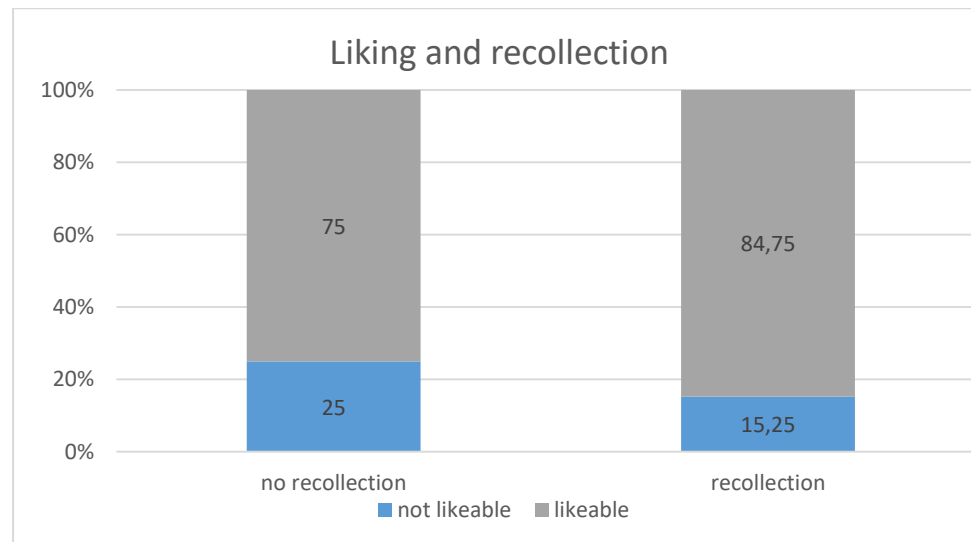
Reliabilitätsstatistiken

Cronbach's Alpha	N der Items
,78	10

7.2.3. Proposition 2c: Character involvement and knowledge

P2c: The more character involvement a programme makes possible, the more effects on knowledge gain.

<u>Liking</u>

Only 6.35 % of the total sample (n=126) have no recollection of the topic being mentioned. Out of this 6.35 %, a third liked the character (6 participants) and 25 % did not like him/her (2 participants). 93.65 % could remember the topic being mentioned. Out of these 93.65 %, the majority liked the character(s) – 100 participants – and 15.25 % did not like the character(s) – 18 participants.

To see if there is a correlation between these two variables, a regression analysis was carried out. The significance is 0.471 and therefore not given.

Variablen in der Gleichung		B	S.E.	Wald	df	Sig.	Exp(B)
Schritt 1	Liking	,62	,86	,52	1	,471	1,85
	Konstante	2,20	,75	8,69	1	,003	9,00

Pearson's Chi square test also did not show the outcomes to be significant (0,612).

Liking and recall (mean)
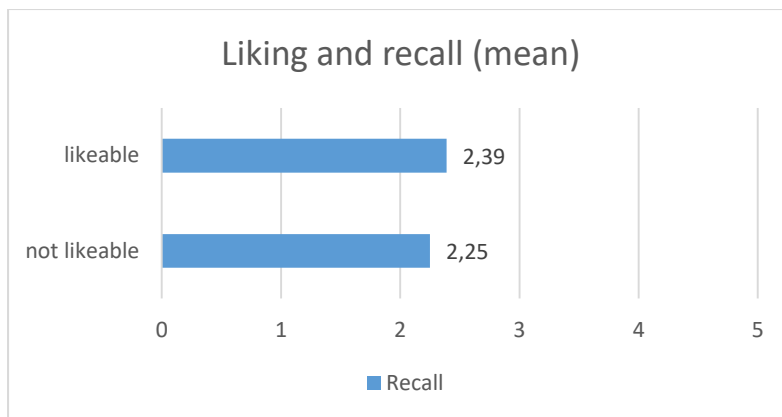
Generally speaking, people who liked the character could remember more facts about Schroedinger's Cat. However, there is no significance here (p-value = 0.527).

Liking and interest
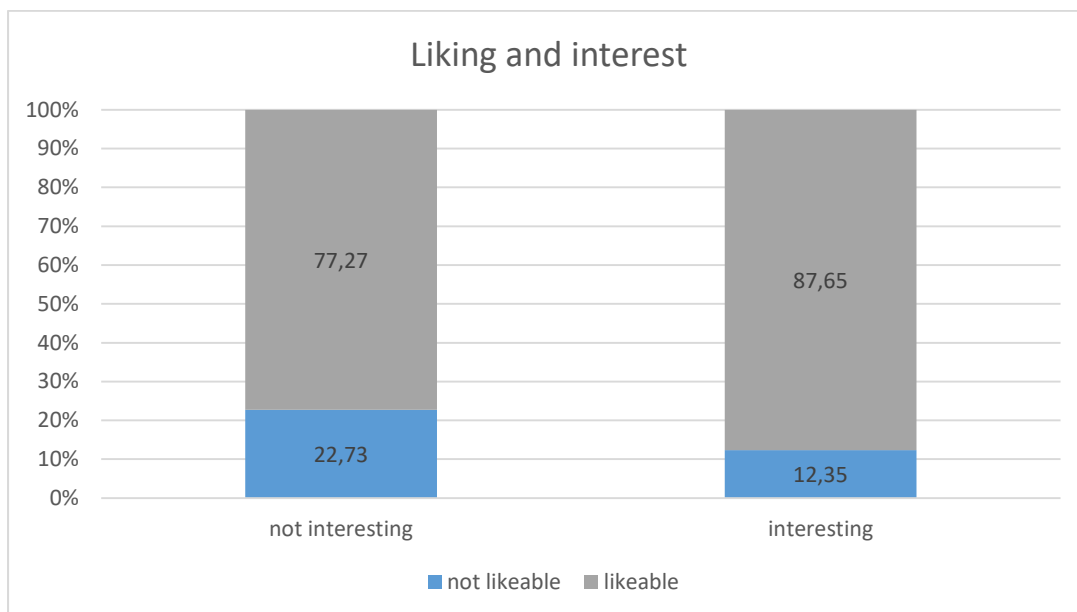
Out of 35.2 % (44 participants) who thought that the topic was not interesting, 77.27 % liked the character(s). A total of 81 participants (64.8 %) thought that the scientific topic was interesting. Here, 87.65 % thought that the character(s) was/were likeable. A regression analysis shows that there is no significance (0.136).

Variablen in der Gleichung

		B	S.E.	Wald	df	Sig.	Exp(B)
Schritt 1	Liking	,74	,49	2,23	1	,136	2,09
	Konstante	,00	,45	,00	1	1,000	1,00

A Chi square test indicated no significance either (0.200).

Liking and personal relevance
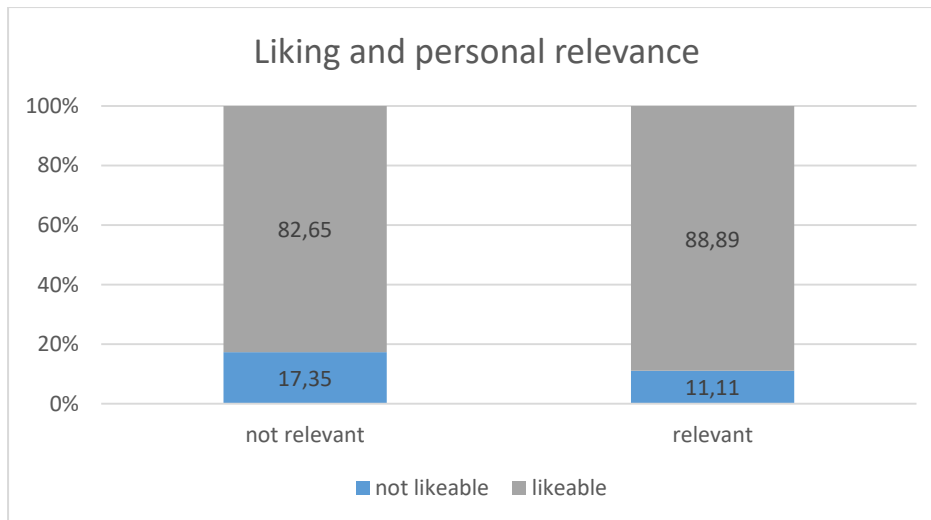
78.40 % of the viewers thought that the scientific topic was not relevant for them. Out of them, 82.65 % liked the character(s). 21.6 % saw a personal relevance in the scientific topic. Here, 88.89 % liked the character(s). There is also no significance according to a regression analysis (0.438).

Variablen in der Gleichung

		B	S.E.	Wald	df	Sig.	Exp(B)
Schritt 1	Liking	,52	,67	,60	1	,438	1,68
	Konstante	-1,73	,63	7,67	1	,006	,18

Again, the Chi square test showed no significance (0,561).

<u>Similarity</u>

Similarity and recollection (mean)
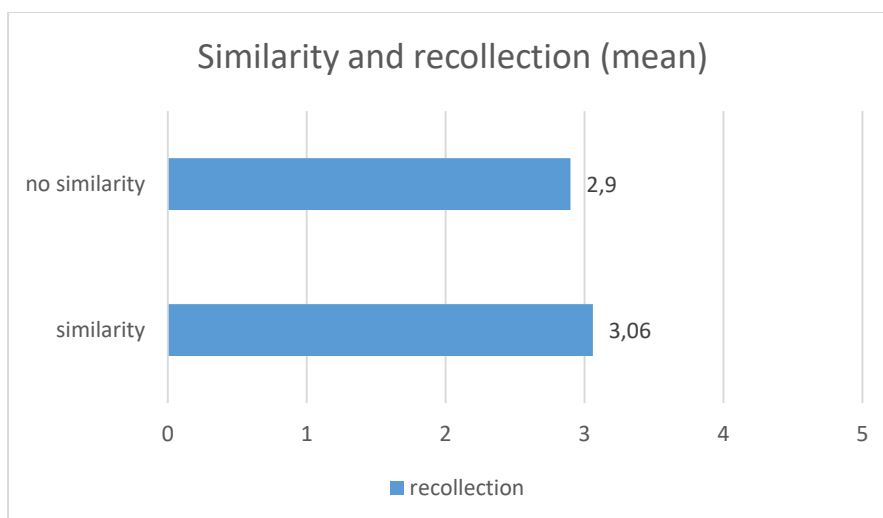
Viewers who perceived similarity with the character(s) had higher mean values concerning recollection of the topic being mentioned. However, there is no significant difference (0.690).

When correlating similarity with recall of Schroedinger's Cat, there is no significant correlation either according to Pearson.

Korrelationen		Abruf Schrödingers Katze	Similarity Mittelwert Zusammenfassung
Abruf Schrödingers Katze	Pearson Korrelation	1,00	,05
	Sig. (2-seitig)		,543
	N	133	128
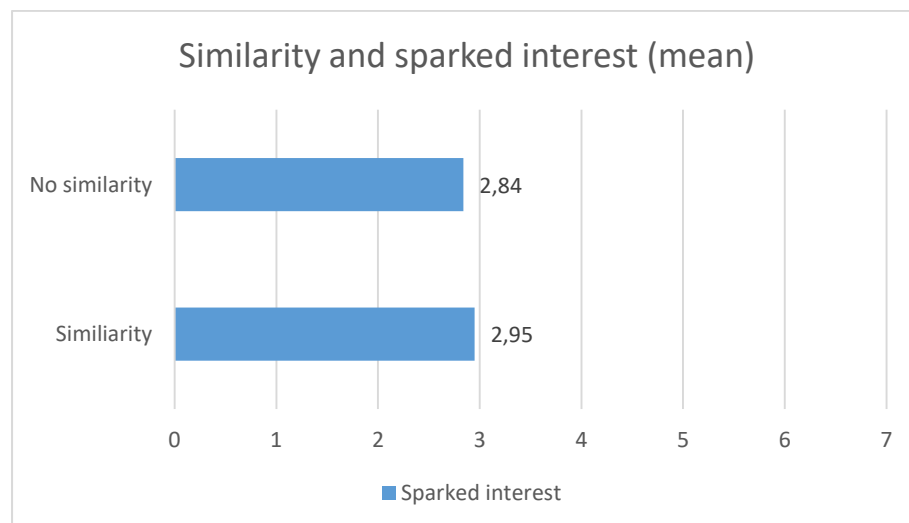
The mean values of similarity with regard to sparked interest showed no significance according to the t-test (0.621).
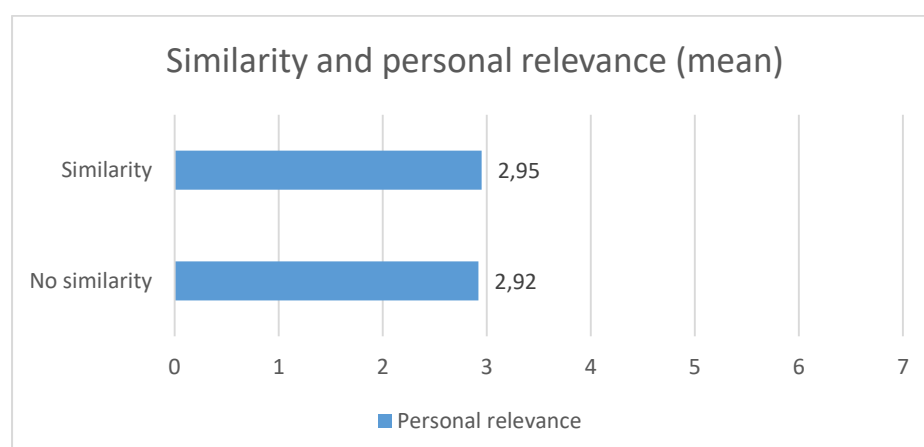
Viewers did not seem to make a connection between perceived similarity and personal relevance. There is no significance with a p-value of 0.915.

<u>Wishful identification</u>

Wishful identification and recollection (mean)

People who had no recollection of the scientific topic rather wished to be like the character(s). Unfortunately, there is no significance (0.385) according to the t-test.

Also, there is no correlation of any sort between recalling Schroedinger's Cat and wishful identification.

Korrelationen		Abruf Schrödingers Katze	Wishful Identification Mittelwert Zusammenfassung
Abruf Schrödingers Katze	Pearson Korrelation	1,00	,08
	Sig. (2-seitig)		,397
	N	133	128
Wishful Identification Mittelwert Zusammenfassung	Pearson Korrelation	,08	1,00
	Sig. (2-seitig)	,397	
	N	128	128

Wishful identification and interest (mean)
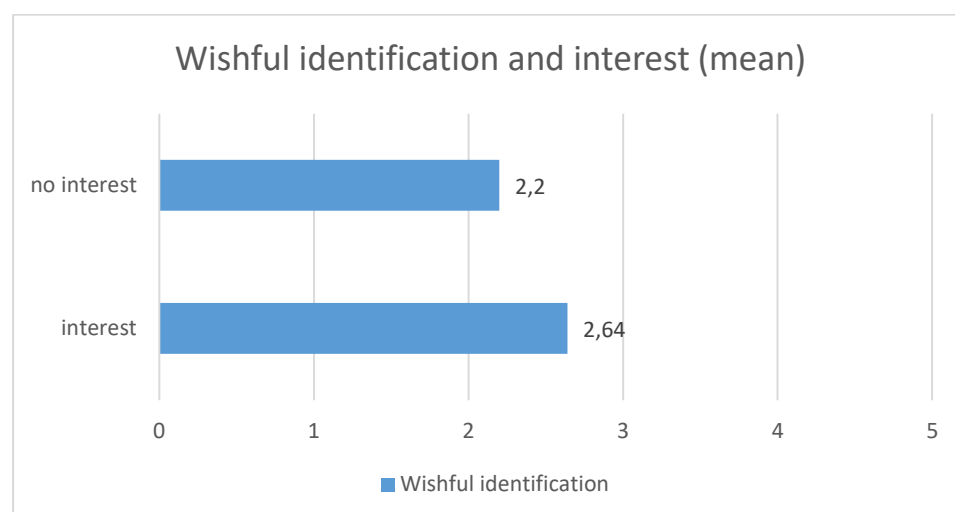
Here, it says that people who wish to be like the character(s) show more interest in the topic. The difference in means is significant with a p-value of 0.001.
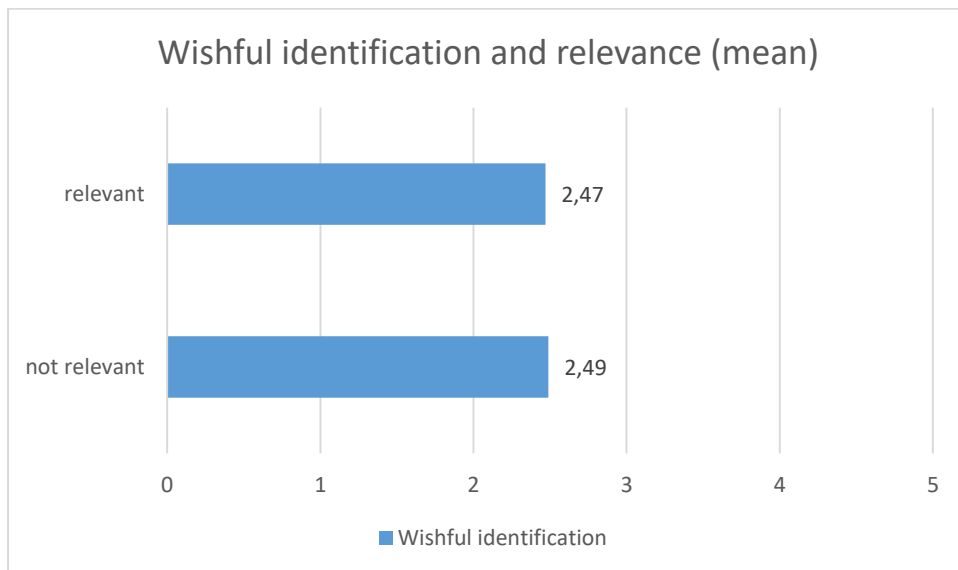
The means of wishful identification and personal relevance are quite similar, however, no significance (0.895) is present.

Parasocial Interaction
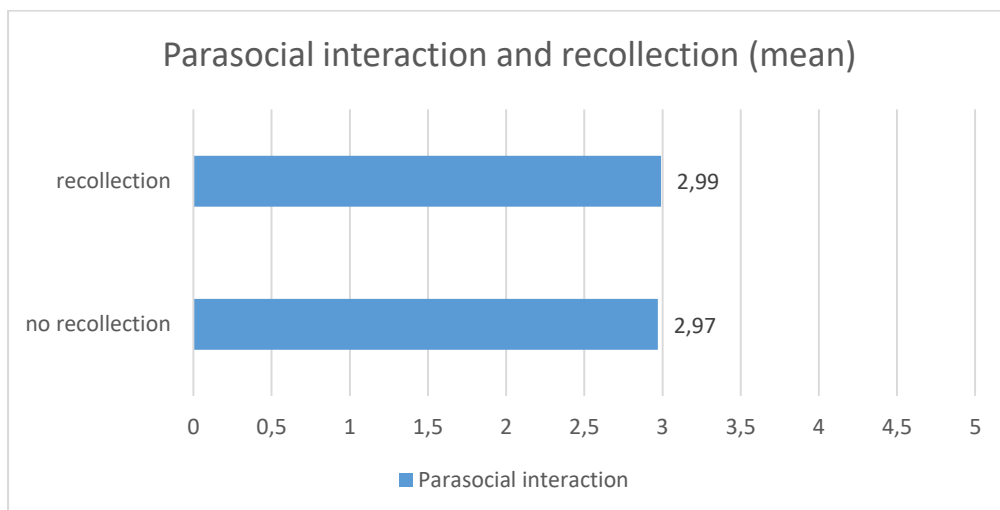
The means of parasocial interaction with regard to recollection of the topic showed no significant differences (0.923)

Korrelationen

		Abruf Schrödingers Katze	Parasocial Interaction Mittelwert Zusammenfassung
Abruf Schrödingers Katze	Pearson Korrelation	1,00	,02
	Sig. (2-seitig)		,832
	N	133	130
Parasocial Interaction Mittelwert Zusammenfassung	Pearson Korrelation	,02	1,00
	Sig. (2-seitig)	,832	
	N	130	130

There is also no significant correlation between recall and parasocial interaction (0.02).
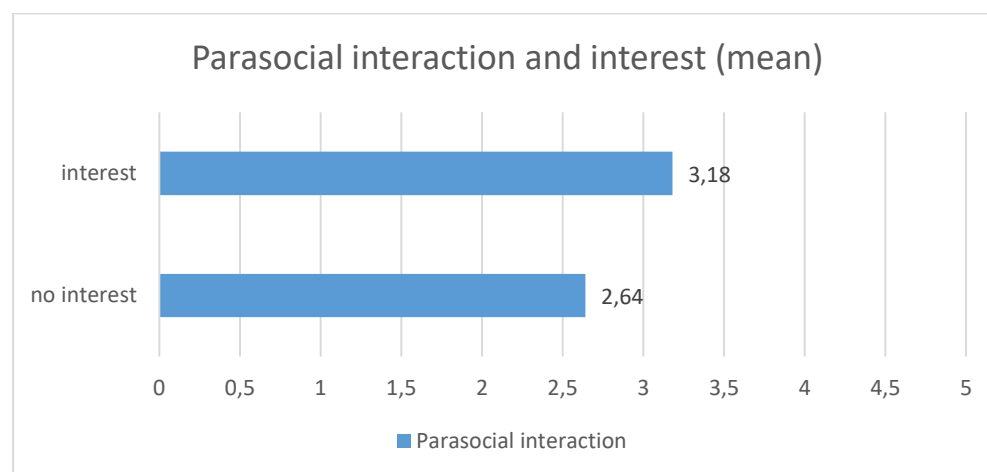
A p-value of 0.000 suggests a high significance of the difference of the mean values. This means that people who showed more interest in the scientific topic where more likely to establish a parasocial interaction with characters.
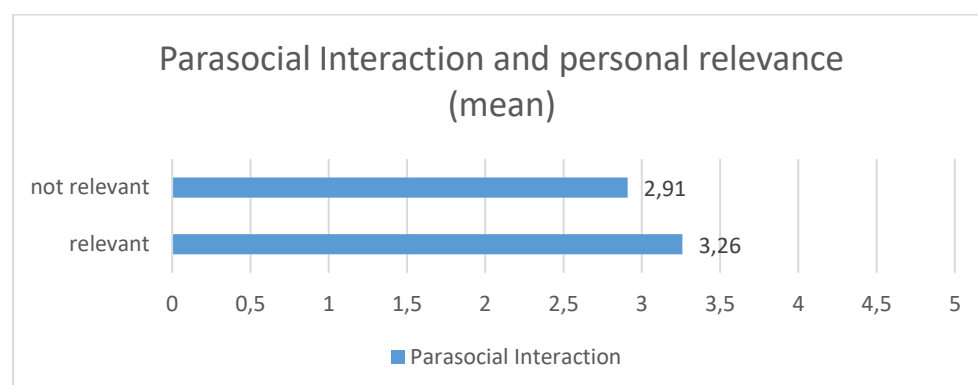
The more parasocial interaction takes place, the more people find the scientific topic relevant for them personally. The difference between these mean values is significant with a p-value of 0.015.

7.2.4. Proposition 2d: Character involvement and attitudes

Liking and attitude (mean)

not likeable	3,51
likeable	3,69
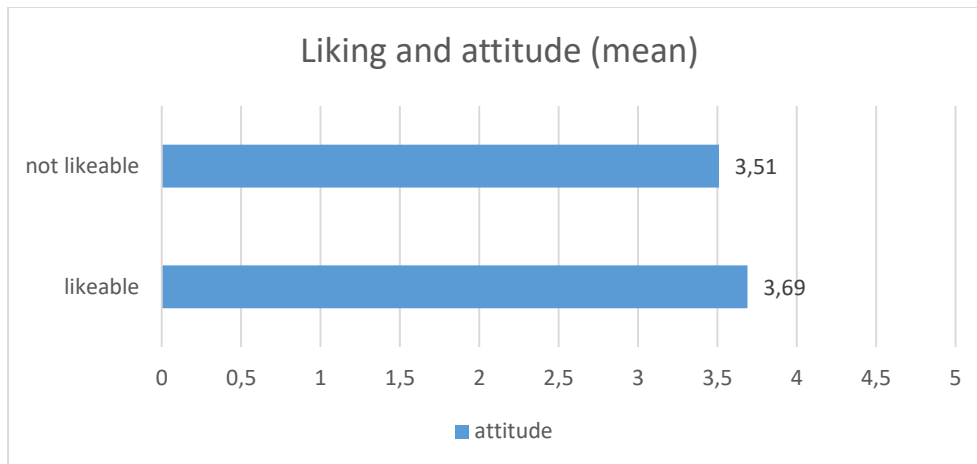
attitude

Even though people had more positive attitudes towards science when they liked a character, this finding cannot be taken as significant (0.069).

Korrelationen

		Similarity Mittelwert Zusammenfassung	Einstellung Mittelwert Zusammenfassung
Similarity Mittelwert Zusammenfassung	Pearson Korrelation	1,00	,10
	Sig. (2-seitig)		,248
	N	128	128
Einstellung Mittelwert Zusammenfassung	Pearson Korrelation	,10	1,00
	Sig. (2-seitig)	,248	
	N	128	133

The Pearson correlation suggests no correlation between similarity and positive attitudes.

Korrelationen

		Wishful Identification Mittelwert Zusammenfassung	Einstellung Mittelwert Zusammenfassung
Wishful Identification Mittelwert Zusammenfassung	Pearson Korrelation	1,00	,20
	Sig. (2-seitig)		,027
	N	128	128
Einstellung Mittelwert Zusammenfassung	Pearson Korrelation	,20	1,00
	Sig. (2-seitig)	,027	
	N	128	133

The more people experience wishful identification, the more they form a positive attitude towards science. This correlation is rather weak with a value of 0.20, however, it is significant.

Korrelationen		Einstellung Mittelwert Zusammenfassung	Parasocial Interaction Mittelwert Zusammenfassung
Einstellung Mittelwert Zusammenfassung	Pearson Korrelation	1,00	,21
	Sig. (2-seitig)		,019
	N	133	130
Parasocial Interaction Mittelwert Zusammenfassung	Pearson Korrelation	,21	1,00
	Sig. (2-seitig)	,019	
	N	130	130

The more people form a parasocial relationship with the character(s), the more they form a positive attitude towards science. Again, it is rather weak correlation of 0.21, nevertheless significant (0.019).

7.3. Proposition 3: Edutainment and social class

The third research question is concerned with the effects of Edutainment messages on social class. Social class was measured with different educational levels with relation to the UNESCO classification. Effects comprised once again knowledge gain and attitudes towards science.

Proposition 3: Edutainment messages can have positive effects on people with a lower education in comparison to people with a higher education.

7.3.1. Proposition 3a: Education and knowledge

P3a: Edutainment messages can have positive effects concerning knowledge of science on people with lower education in comparison to people with a higher education.

Eudcational level and recollection
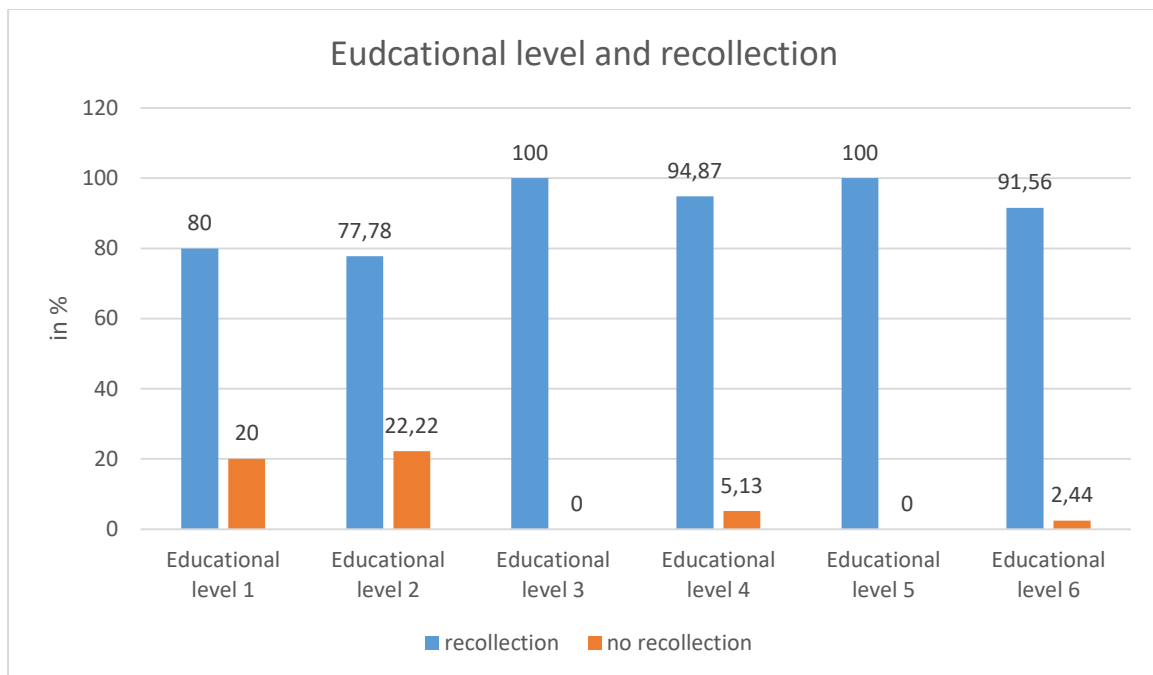
This figure shows the different educational levels and the recollection of the scientific topic. Most participants of all social backgrounds have high recollections. However, we can see that rather lower classes tend to not remember the scientific topic (20 % of educational level 1 and 22.22 % of educational level 2). These findings are significant with a Pearson Chi square value of 0.030.

Educational level and recollection (mean)
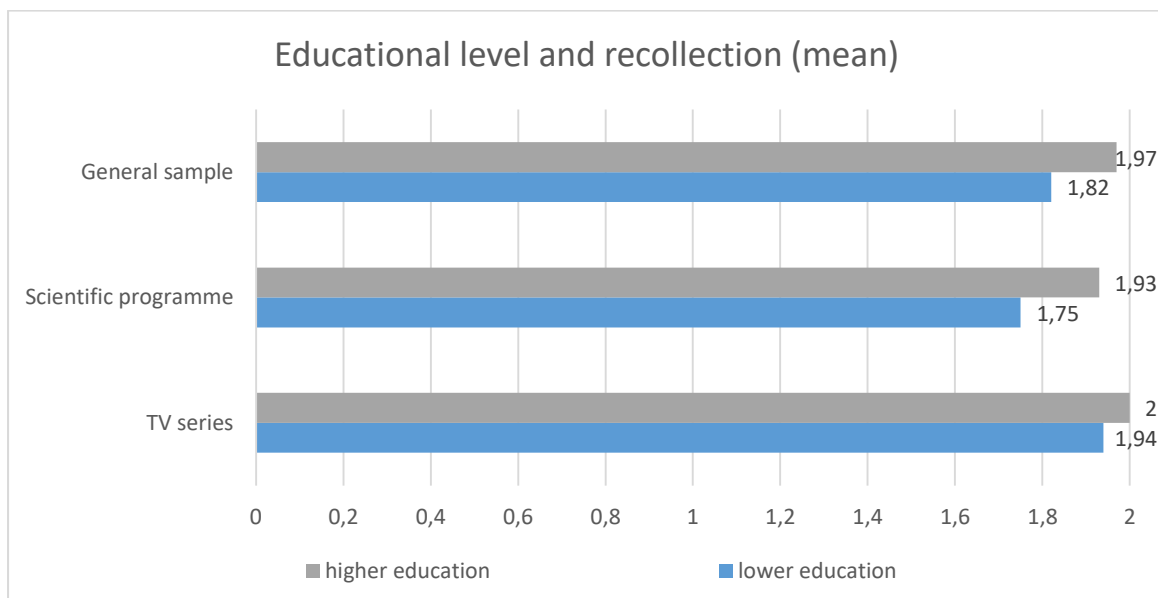
When categorising the educational levels in lower education (1-3) and higher education (4-6), a t-test shows (with a significance of 0.004) that people with a higher education of the general sample tend to have more recollection of the scientific topic being present. The difference in means of the TV series is a trend (0.087) and of the scientific programme

significant (0.041). Even though people with higher education tend to have more recollection, we can see in this figure that with the TV series, the mean of the lower education is the highest.

When looking at educational levels of the general sample and their correlation with the recall of Schroedinger's Cat, we can see that there is a positive correlation of 0.43 with a significance of 0.000. The more education the viewers had, the more facts they could recall about Schroedinger's Cat.

Korrelationen

		Bildung	Abruf Schrödingers Katze
Bildung	Pearson Korrelation	1,00	,43
	Sig. (2-seitig)		,000
	N	132	132
Abruf Schrödingers Katze	Pearson Korrelation	,43	1,00
	Sig. (2-seitig)	,000	
	N	132	133

The same is the case with the TV series (0.36) and the scientific programme (0.40).

Korrelationen

		Bildung	Abruf Schrödingers Katze
Bildung	Pearson Korrelation	1,00	,36
	Sig. (2-seitig)		,004
	N	63	63
Abruf Schrödingers Katze	Pearson Korrelation	,36	1,00
	Sig. (2-seitig)	,004	
	N	63	64

Korrelationen

		Bildung	Abruf Schrödingers Katze
Bildung	Pearson Korrelation	1,00	,40
	Sig. (2-seitig)		,001
	N	69	69
Abruf Schrödingers Katze	Pearson Korrelation	,40	1,00
	Sig. (2-seitig)	,001	
	N	69	69

(TV series)   *(Scientific programme)*

This outcome is supported by a t-test that shows that more people of higher education could remember more facts about Schroedinger's Cat (significance of 0.000). The difference between means of the TV series is not significant (0.154). The difference between means of the scientific programme is significant (0.008).

Here, we can see too that the lower education sample of the TV series had the highest mean, however, this finding is not significant.

Recall (mean)

- Scientific programme: higher education 2,2; lower education 1,64
- TV series: higher education 2,81; lower education 2,5
- General sample: higher education 2,52; lower education 1,95

■ higher education   ■ lower education
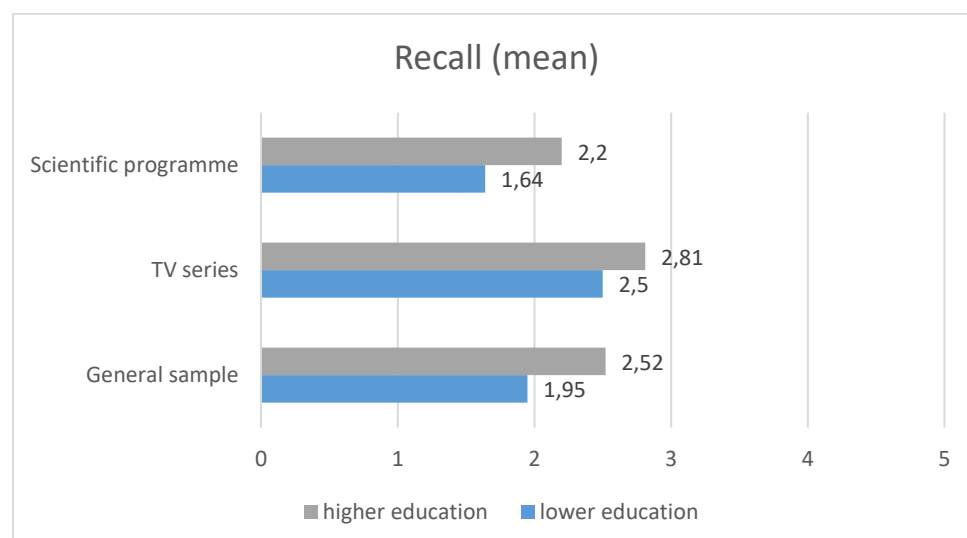
The following figure shows how sparked interest is distributed between educational levels. This outcome is significant according to a Pearson Chi square test (0.039).
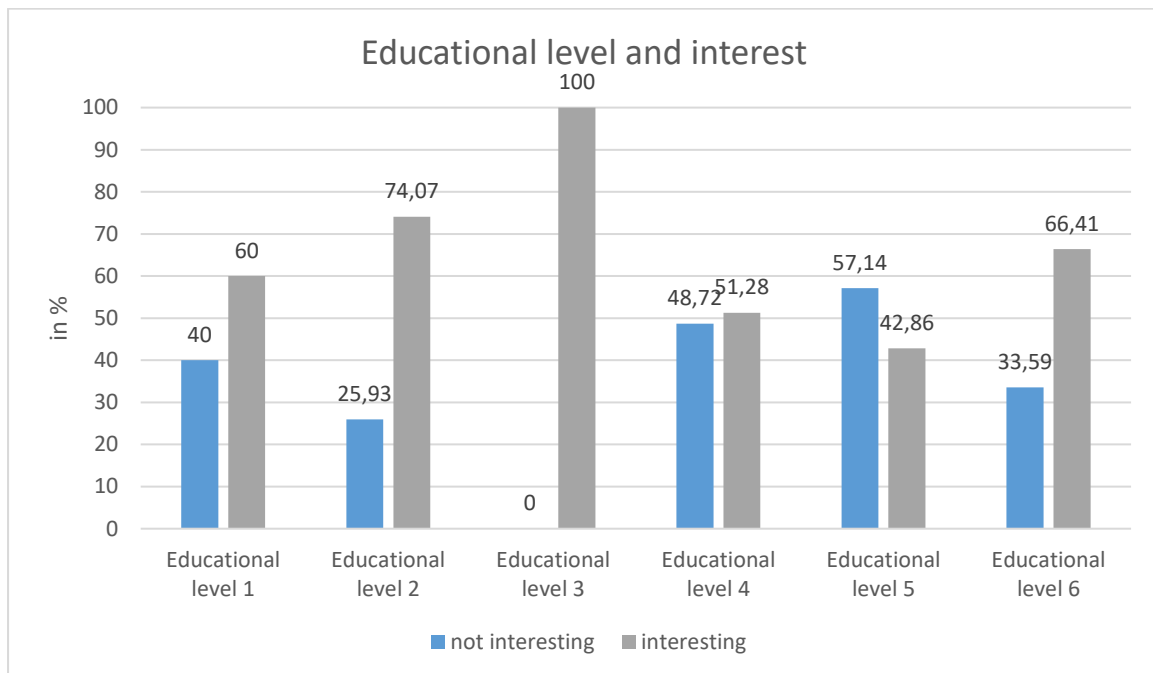
Evaluating sparked interest in combination with educational levels, only the scientific programme could achieve a significant difference (0.040). The general sample had a p-value of 0.141 and the TV series a p-value of 0.283. The means would show that lower education participants had the highest score with the TV series.
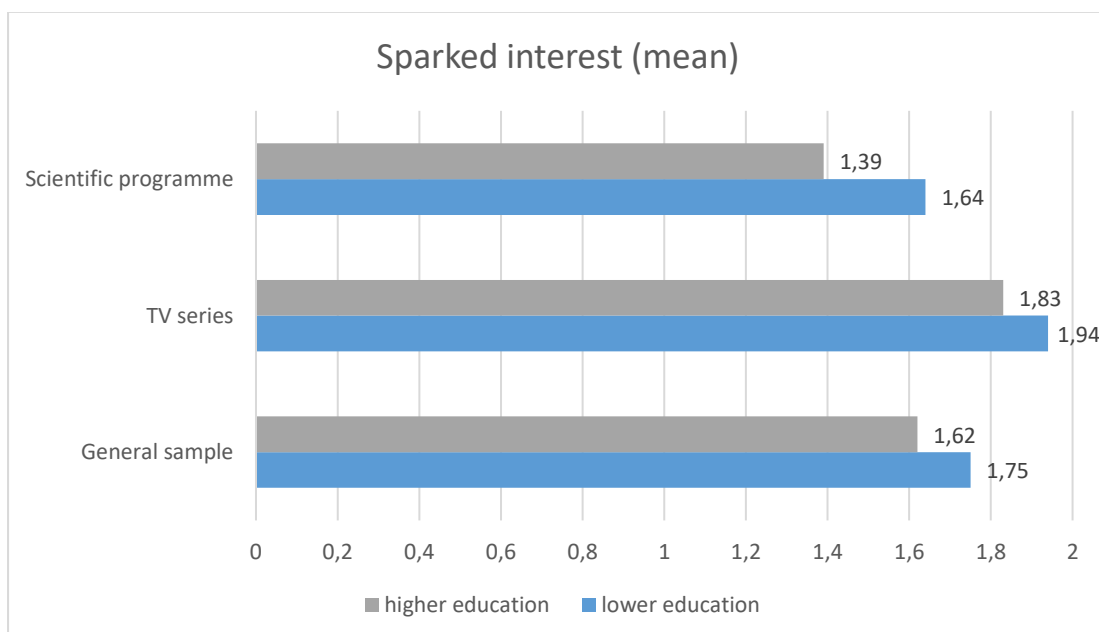
As most participants (102 in contrast to 29) did not see any personal relevance in the scientific topic, we cannot make any statement about the correlation of educational level and personal relevance. (Person Chi square test = 0.220).

Personal relevance
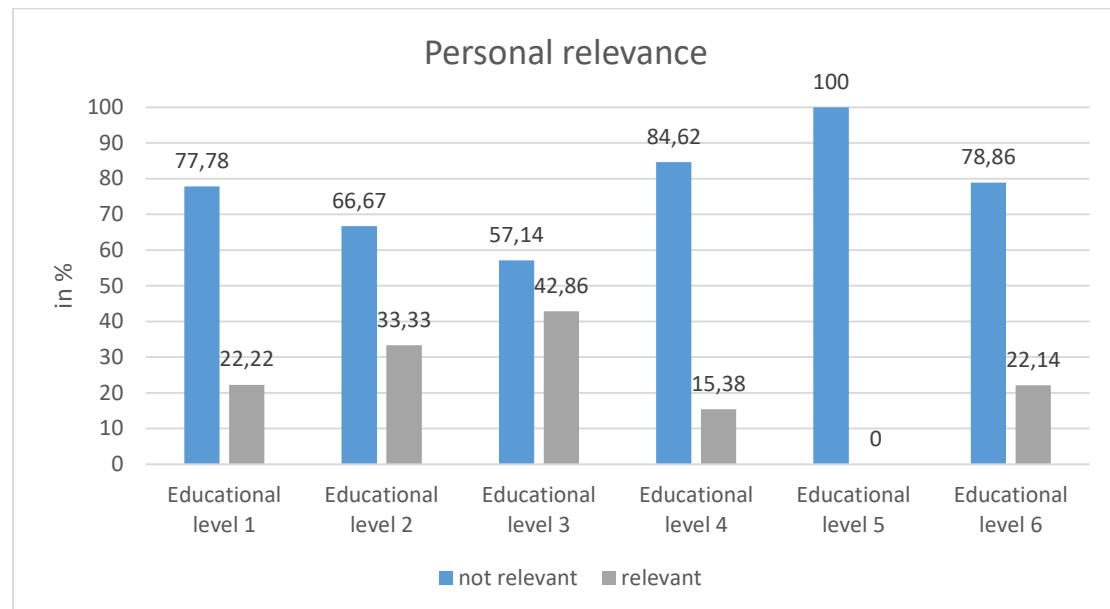
However, more people of lower education found personal relevance in the scientific topic (0.045) according to the t-test. The outcomes of the scientific programme are also significant with a value of 0.000. However, the results of the TV series are not (0.399). The figure below shows that the participants with lower education had the highest mean with the TV series.

Educational level and personal relevance (mean)
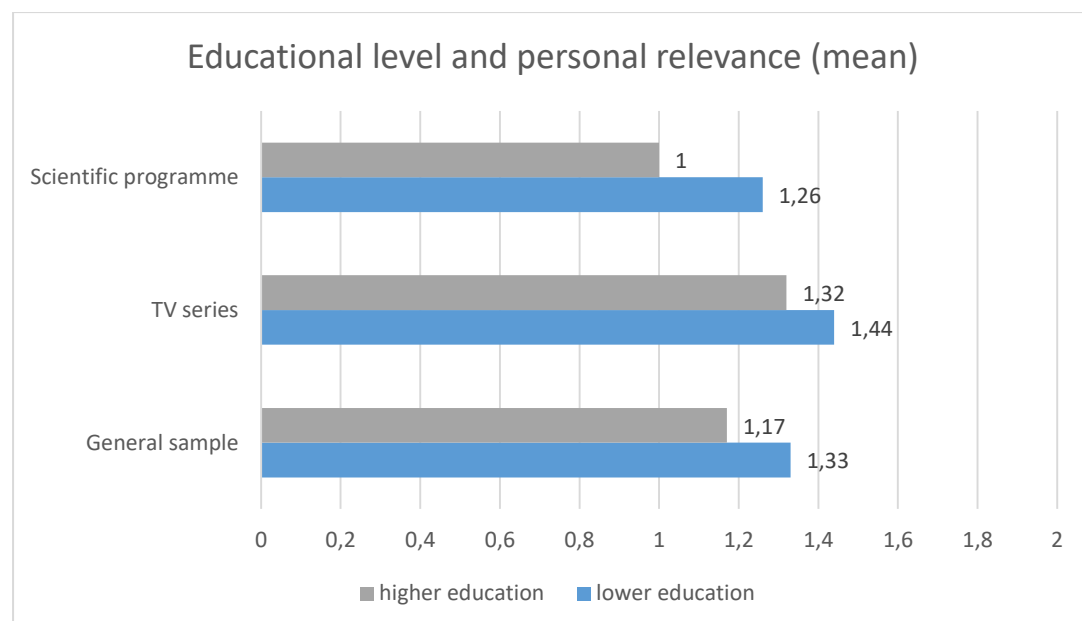
7.3.2. Proposition 3b: Education and attitude

In general, it shows that attitudes correlate positively with attitudes. This means that the more educated people are, the more positive the attitudes are towards science.

Korrelationen

		Bildung	Einstellung Mittelwert Zusammenfassung
Bildung	Pearson Korrelation	1,00	,30
	Sig. (2-seitig)		,000
	N	132	132
Einstellung Mittelwert Zusammenfassung	Pearson Korrelation	,30	1,00
	Sig. (2-seitig)	,000	
	N	132	133

This outcome is also true for the TV series (although only a trend with a significance of 0.055), and for the scientific programme (0.020).

Korrelationen

		Bildung	Einstellung Mittelwert Zusammenfassung
Bildung	Pearson Korrelation	1,00	,24
	Sig. (2-seitig)		,055
	N	63	63
Einstellung Mittelwert Zusammenfassung	Pearson Korrelation	,24	1,00
	Sig. (2-seitig)	,055	
	N	63	64

Korrelationen

		Bildung	Einstellung Mittelwert Zusammenfassung
Bildung	Pearson Korrelation	1,00	,28
	Sig. (2-seitig)		,020
	N	69	69
Einstellung Mittelwert Zusammenfassung	Pearson Korrelation	,28	1,00
	Sig. (2-seitig)	,020	
	N	69	69

(TV series)   *(Scientific programme)*

There were no significant results comparing means of attitudes with educational levels according to a t-test (general sample = 0.199, TV series = 0.905, scientific programme = 0.251).

88
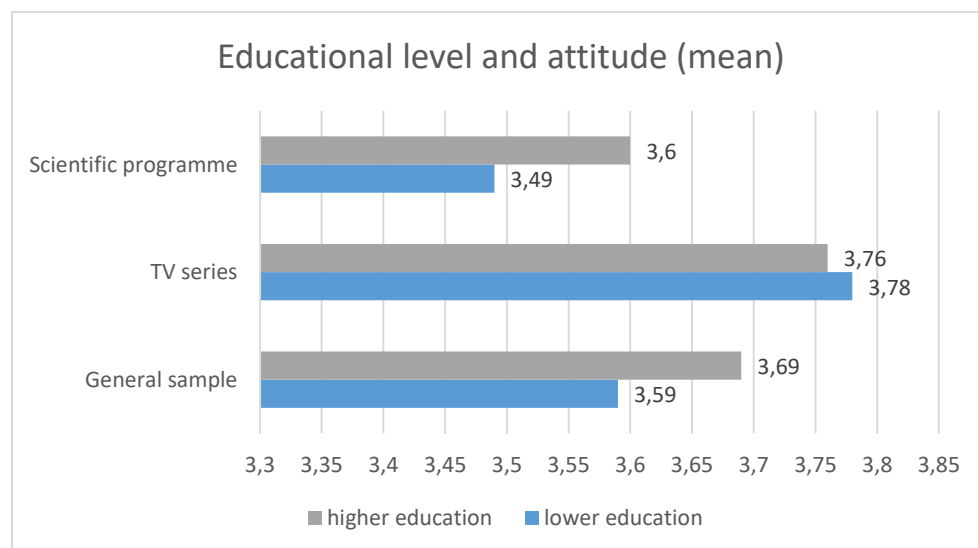
7.4. Proposition 4: Edutainment and gender

The last research question was concerned with the influence of Edutainment on gender.

Proposition 4: Edutainment messages can have positive effects on females in comparison to males.

7.4.1. Proposition 4a: Gender and knowledge

First, the correlation between gender and recollection of the topic was evaluated.
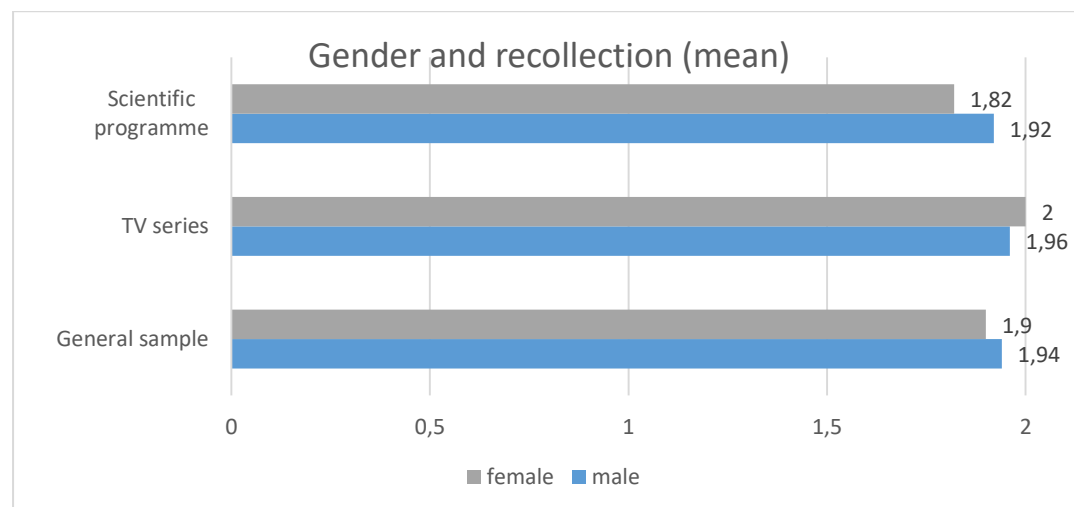
Here, it is interesting to see that females scored the best rest results with the TV series. In the general sample and the scientific programme, they were surpassed by males. Unfortunately these findings are not significant (general sample = 0.423, TV series: 0.236, scientific programme: 0.255).
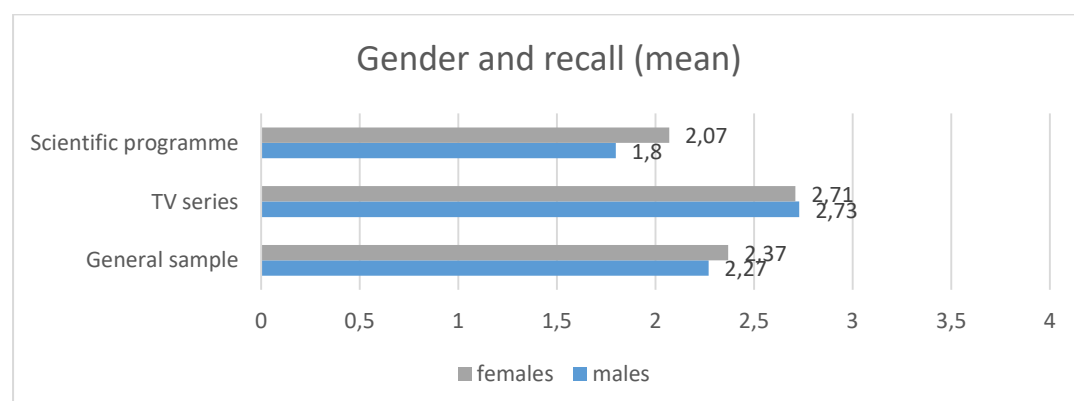
Remembering facts about Schroedinger's Cat, males scored better results with the general sample and the scientific programme. With the TV series, the results were nearly the same.

However, none of these outcomes are significant (general sample: 0,565, TV series: 0.916, scientific programme: 0.214).
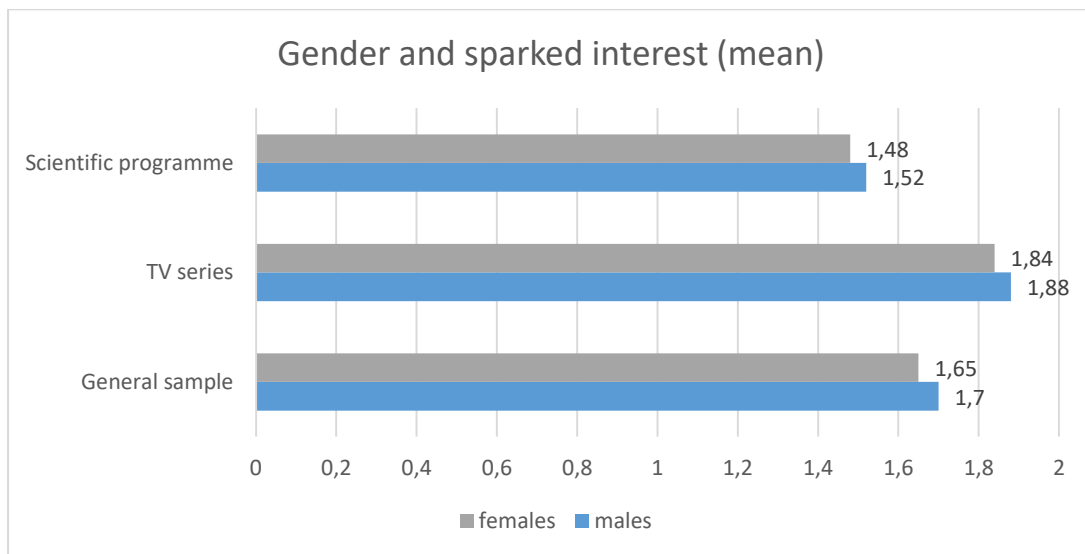
Comparing sparked interest with gender, no significant results were achieved, either (general sample 0.529, TV series: 0.680, scientific programme: 0.738). What we can see here though is that males tended to be more interested in science. Females, however scored the highest means with the TV series.
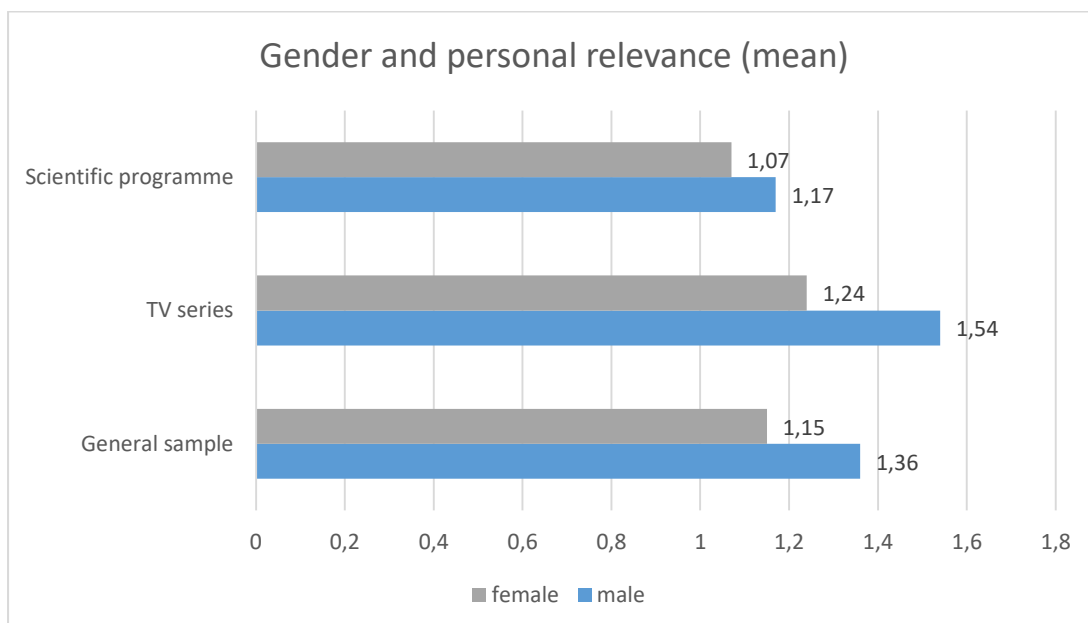
The difference of means was significant with the general sample. This shows that male participants saw more personal relevance in the scientific topic (0.004). The same is true for the watchers of the TV series. Males had higher values than females (0.013). However, female viewers scored higher means when compared to the general sample. The means of the scientific programme were not significant with a p-value of 0.207.

7.4.2. Proposition 4b: Gender and attitude
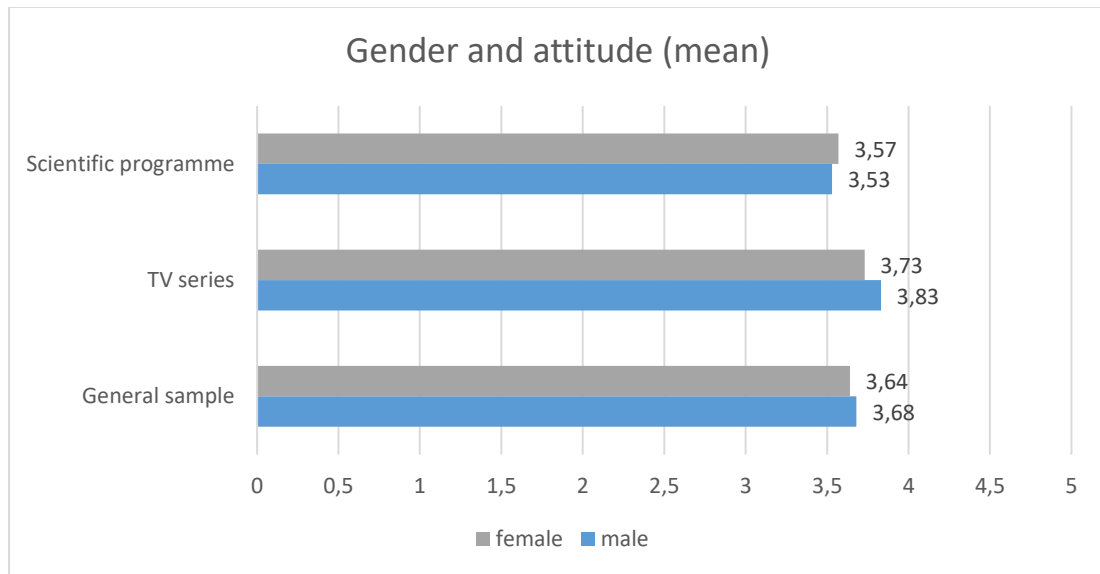
There were no significant outcomes when measuring attitudes and gender (general sample: 0.587, TV series: 0.268, scientific programme: 0.664).
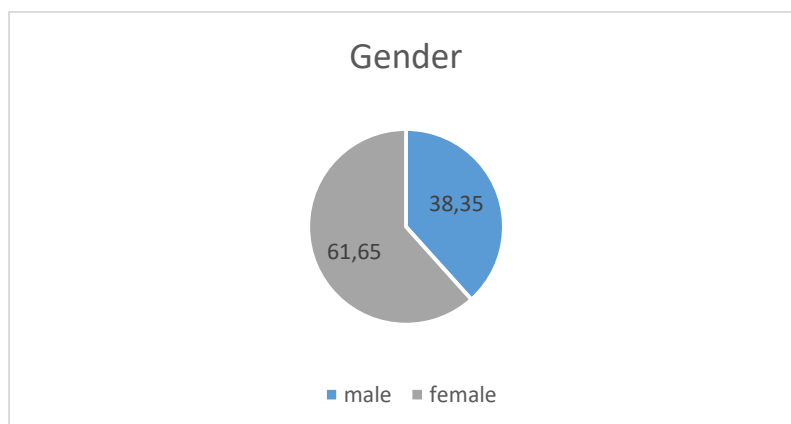
When analysing the total sample, it became clear that gender was not normally distributed. It consisted of 51 men and 82 women and a Kolmogorov-Smirnov test showed that, too (significance of 0.000).

Kolmogorov-Smirnov Test für eine Stichprobe		Geschlecht	Einstellung Mittelwert Zusammenfassung
N		133	133
Normal Parameter	Mittelwert	1,62	3,66
	Std. Abweichung	,49	,40
Größte Differenz	Absolut	,40	,07
	Positiv	,28	,07
	Negativ	-,40	-,05
Kolmogorov-Smirnov Z		4,62	,85
Asymp. Sig. (2-seitig)		,000	,470

8. Discussion

Q1: What effects can an Edutainment programme have on viewers in contrast to a scientific programme?

The Proposition 1a was concerned with knowledge gain and the two different programmes. Knowledge, according to the literature research, can be defined as the outcome of learning. It must not only be acquired but also remembered to be useful. This recall of the scientific issue was measured by items that represented said topic (Hunt, 2003:101fff.). Foster also stated that people have to develop an interest towards the content (Foster, 2008:600; Sood/Menard/Witte, 2004:123). McGuire (1989) added that it has to be measured if the topic is perceived as personally relevant in order to facilitate learning. Knowledge gain can be seen as a basis for forming an attitude, and eventually, a change in behaviour (Rogers, 2003). Sood/Menard/Witte (2004:123) also stated that steps include the exposure to the message, the attention to it, and the interest in the message. Furthermore, the message has to be understood and perceived to be of a personal relevance. They also say that the message has to be remembered.

The question is, here, if Edutainment supports these processes of knowledge gain in a more efficient way than an educational programme in a more documentary style. First, it has to be mentioned that most viewers (90.98 %) of both programmes could remember that the scientific topic was part of the exposure. In the "Big Bang Theory", the topic was embedded into another story and took up approximately five of twenty minutes. It was dealt with towards the end of the episode. In the scientific programme, the whole episode was dedicated to Schroedinger's Cat. However, the concept itself was explained in the beginning (0:00 – 0:51) and then it was further elaborated in the context of quantum mechanics. For that reason, one must think that more viewers of the scientific programme could remember the topic being part of the episode, as it was dedicated to it. However, the watchers of the TV series were clearly more familiar with the topic (98.41 % compared to 85.51 %), even though it was not the main topic. Here, the concept of Schroedinger's Cat was used as an advice for two protagonists and helped them to get on with their relationship. It clearly helped the story to evolve and was therefore easy to remember. Therefore, the proposition can be confirmed as the difference between the two means of the TV series and the scientific programme is significant (0.007).

When it comes to recalling information about Schroedinger's Cat, the watchers of the TV series were also in the lead and could mostly remember more than the ones of the scientific programme (4-6 facts remembered: 56.25 % compared to 17.39 % and 7 and more facts remembered: 10.94 % compared to 5.80 %). It can also be argued here that, because

the scientific topic was essential for evolving the relationship between the two characters, it was important for understanding the whole story of the episode. In the scientific pro-gramme, the story of Schroedinger's Cat was not embedded into a "bigger picture". Also, it was linked to quantum mechanics so people could have had a hard time to isolate the scientific topic itself within this information flood. This is shown by the result of people not remembering any facts: 31.88 % of the scientific programme viewers did not write down a single fact in comparison to 6.25 % of the TV series. This also confirms the proposition 1a, as more facts were remembered after watching the TV series.

Furthermore, it has to be noticed that the scientific topic generally sparked a lot of interest in the viewers of both programmes (66.67 %). However, more viewers of the TV series found the topic interesting (85.71 % compared to 49.28 %). Interest, as being part of the concept "knowledge", can therefore be accounted for the TV series. Here, it can be argued that linking the scientific topic to a story line, but not fully elaborating it, might motivate viewers to further concern themselves with the topic.

Personal relevance, on the other hand, did not reach high values in both groups. Most of the viewers (77.27 %) did not see a relevance for their personal life. It has be noted, how-ever, that Schroedinger's Cat and quantum mechanics in general are very abstract con-cepts that are not very relatable to everyday life. More viewers of the TV series did see a personal relevance (35.94 % compared to 10.29 %) which can be explained by the topic being relevant in the love life of the characters of "The Big Bang Theory". Some partici-pants even mentioned that the concept can be used as a metaphor of needing to try things out in order to be sure about the outcome, as it was the case in the TV series. In the scientific programme, the host even said that quantum mechanics has very little to do with our normal lives. Nevertheless, the difference between the two means is highly significant (p-value of 0.000).

Additional information can be provided when correlating the concepts of knowledge. The more people can remember about the scientific topic, the more they find it interesting. This shows that knowledge gain in fact depends on interest in the topic. Moreover, finding the concept interesting correlates positively with personal relevance. This means that the more interesting viewers find the topic, the more relevant it seems to them.

Most viewers of the TV series said that they understand the concept of Schroedinger's Cat because of their (prior) exposure to it. Here we can see that there is a learning effect present. Most viewers of the scientific programme did not understand the concept at all (67.16 %). It can be interpreted here that watching the TV series gives people the confi-dence to say that they understand the topic being presented. It is also interesting to notice that 36.51 % of the TV series watchers have seen this particular episode of The Big Bang Theory before. This means that the range is quite high and a lot of people of the general

population can be reached when wanting to induce societal changes. As Singhal/Rogers (1999:9) have said, the purpose of Edutainment strategies is to cause social changes through educating and entertaining programmes.

In conclusion, the proposition that exposure to an Edutainment programme leads to more knowledge gain than to a scientific programme can be confirmed.

The next step of this discussion will be the evaluation of the results concerning attitudes and Edutainment. The literature research suggested that attitudes are generated by an exposure to a certain object (Singh, 2015:201). It was argued that messages embedded in entertainment television programmes are able to influence people's awareness and attitudes towards certain issues, although more empirical work is needed to verify that argument (Moyer-Gusé, 2008:407f.). Nevertheless, a producer's aim is mostly not to influence behaviour but to entertain and make profit (Moyer-Gusé, 2008:409). It can also be interpreted that the main aim of The Big Bang Theory is not about educating the audience about the importance of science (Bednarek, 2012:202). It is therefore interesting to see if positive attitudes can be linked to the exposure of this programme anyway.

First, it has to be mentioned that the findings here have to be interpreted with caution. There are no data concerning attitudes towards science prior to the exposure which means that it could not be directly traced back to said exposure. It would be possible that in one group, in general, people have been more approving of science than the other beforehand. However, as both groups were selected randomly and have been under the same experimental conditions, we can still compare the findings, although with limitations.

To be able to measure "attitude", the subscales "Views of Science and Scientists", "Attitude to Scientific Inquiry", "Adoption of Scientific Attitude", "Relevance of Science", and "Social Implications of Science" were first recoded in the same direction and then transformed into one single variable called "Attitude towards Science". A reliability analysis proofed that this was possible.

Speaking in general terms, the mean of attitude towards science is 3.66 (out of 5) and thus more positive in general. The mean of the TV series is higher than the general mean with 3.77 and also higher than the mean of the scientific programme with 3.55. We can therefore say that the attitude towards science is more positive after watching the TV series. This can also be said when summarising the variables. In conclusion, the proposition 1b can be confirmed as the viewers of the TV series have a more positive attitude towards science after exposure to the programme.

This outcome is especially important when wanting to induce behavioural change. For example, if the aim is to engage more people in scientific activities or increase the number of people taking up a profession in science, this could be accomplished by Edutainment messages. Attitudes have the ability of predicting behaviour (Petty/Fabrigar/Wegener,

2003:754). If a message is understood and the proposed behaviour is in accordance with their lifestyle, people rather tend to accept the proposed behavioural change (Sood/Menard/Witte, 2004:123). Behavioural change firstly depends on increased knowledge of the topic, and consequently on a formed attitude towards it (Rogers, 2003). To sum up the outcomes of the research question 1, it can be said that when people are exposed to an Edutainment programme, they will experience more effects than viewers of a scientific programme.

Q2: Does involvement in narrative and with characters correlative with positive effects on viewers?

The involvement of viewers in a narrative depends largely on the narrative structure of programmes. Viewers have to be convinced to immerse in the storyline and to follow the events that unfold (Moyer-Gusé, 2008:409). A narrative structure consists, among other things, of a three-act structure with an introduction to the story, a conflict, and a turning point (Mason, 2005:38). This structure enables transportation (Green/Brock, 2000:701), where people are immersed into a storyline, and consequently experience knowledge gain from narrative messages (Knowles/Linn, 2004). Slater (2002) even says that successful persuasion of the message cannot happen without transportation. It is a key mechanism that can influence attitudes and beliefs. Viewers tend to become concentrated on events occurring in the story and experience powerful emotions that lead them to adapt their beliefs and behaviours to be more consistent with the story they are exposed to (Green/Fitzgerald, 2017).

The second research questions deals exactly with this proposition of transportation. This narrative involvement was measured with a scale of Busselle/Bilandzic (2009) that made use of the concepts of transportation, identification, presence, and flow. A reliability analysis actually showed that their scale worked in the setting of this master's thesis.

It was suggested that the more people are immersed in a programme, the more they will experience knowledge gains (P2a). When interpreting the results of that research question, one has to notice that people watching the TV series were in fact more immersed in the story than people watching the scientific programme. This confirms the findings of the chapter "Stimulus material" where the TV series and the scientific programmes were analysed in terms of narrative elements. There, it was argued that a TV series (sitcom) consists of a three-act structure (Carter, 2001) and narrative elements like equilibrium, disruption, and resolution, for instance (Todorov, 1977). It therefore makes narrative involvement more likely. It was also demonstrated that narratives in scientific programmes are tricky to implement, as logical-scientific communication is generally not driven by conflict (De Jong,

2011:98fff.) and the structure relies more on an introduction of a statement and further exploration of that thesis (De Jong, 2011:106).

Looking at the result of the present empirical work, it has to be stated that there is no correlation between narrative engagement and recollection of the topic being present. This can be explained with the high value of recollection in general, regardless of the programme watched. This means that it does not matter what programme audience members watch and if there is narrative involvement or not, people could still remember hearing the topic being mentioned. However, there is a positive correlation between the involvement in narratives and recalling the topic of Schroedinger's Cat. This means that the more people are involved with the story, the more they can actually remember about the scientific topic. It is also evident that narrative involvement leads to a gain in interest and relevance with regard to the topic. It can be argued that people tend to find a scientific topic more interesting and relevant when they are immersed into a story.

Additionally, it was proven that narrative involvement correlates positively with more positive attitudes (2b). Thus, it can be stated that people who are more immersed in a story tend to have more positive attitudes towards science. It can be interpreted that people who are swept up in the storyline tend to adapt their views and beliefs to be consistent with the ones suggested by the storyline (Green/Fitzgerald, 2017).

Besides narrative involvement, the literature also recommended to look at involvement with characters. It was suggested that characters have the power of being role models and inspire people to change their perspectives (The World Bank, 2017). Involvement with characters leads watchers to "turning into the characters" and losing self-awareness. It is argued that narrative genres are more likely to generate identification than scientific programmes. When characters speak directly to the audience, it reminds them constantly of their role as watchers (Cohen, 2001:258).

To measure character involvement, it was suggested to use the concepts of similarity (Eyal/Rubnin, 2003), wishful identification (Giles, 2002:12), and parasocial interaction (Horton/Wohl, 1956:215). Scales of McCroskey/Richmond/Daly (1975) – perceived similarity, Hoffner/Buchanan (2005) – wishful identification, and Rubin/Perse (1987) – parasocial interaction – where used to measure character involvement. Cohen also argued to use the concept of liking as it could lead to a parasocial relationship (Moyer-Gusé, 2008:411). All these scales were evaluated according to their reliability and they all have relatively high Cronbach's Alpha values.

When looking at character involvement and Edutainment, we can see that liking and (perceived) similarity did not play a significant role when comparing both programmes. The characters were generally liked, no matter what programme. It can be argued that this is a positive outcome, as liking leads to a parasocial relationship and further to persuasion

of a message. However, these findings are not significant and cannot be taken as generally applicable. An explanation would be that the sample was unevenly divided as the majority liked the character(s) (106 out of 133) and thus no significant difference could be investigated.

People watching the scientific programme tended to feel even slightly more similar to the character, however, this finding is also not significant. Therefore, no significant statement can be made about both programmes and perceived similarity of audience members. Similarity facilitates identification and describes the degree to which viewers perceive them to be similar to the characters. This similarity concerns physical attributes but also personality, beliefs, etc. (Eyal/Rubnin, 2003). It can be interpreted that Harald Lesch was perceived as more authentic, as he actually acted like himself and not a character. The characters of the Big Bang Theory could have been to stereotypical in terms of being "nerds", and therefore left little space to find similarities. But again, no significant outcomes have been achieved, here.

What we can say, nevertheless, is that the means of wishful identification between the TV series and the scientific programme showed a trend of 0.088. More people of the TV series found the character(s) to be inspired by. As this difference is merely a trend, interpreting is only possible with caution.

Finally, the differences between means of parasocial interaction compared with the type of programme was highly significant. This means that people of the TV series had more of a parasocial interaction with characters than the ones of the scientific programme.

To sum it up, we can say that in this investigation, character involvement achieved only mixed results. People of the TV series tended to have more of a parasocial interaction with characters and were more likely wishing to identify with them, nevertheless, nothing significant can be stated about perceived similarity and liking.

In a next step, it was evaluated if character involvement correlated with a gain in knowledge. With regard to the previous results, it is evident that these correlations (especially liking and similarity) could not achieve the expected outcomes. This master's thesis showed no significant correlation between liking and recollection of the topic, liking and recall of the topic, liking and interest in the topic, and liking and personal relevance. Thus, the proposition that liking a character leads to knowledge gain can neither be confirmed nor dismissed. The same is true for perceived similarity. There was no significant difference of means of similarity with regard to recollection of the topic and no significant correlation between similarity and recall of Schroedinger's Cat. Moreover, there were no significant outcomes of similarity and sparked interest as well as similarity and personal relevance. Therefore we cannot make any assumptions about a correlation between similarity and knowledge.

The third concept to measure character involvement was wishful identification. Here, no significant statement can be made about the correlation with recollection of the topic. However, there were only 8 people who could not remember the topic at all and therefore, a significant result is difficult to achieve. Also, no significant correlations between wishful identification and recall of Schroedinger's Cat/personal relevance were observed. However, correlating wishful identification and interest, there was a significant result. The outcome is that the more people wish to be like the character, the more they were interested in the scientific topic. To sum up the concept of wishful identification, the only reliable result was that people were more interested in the topic when they wanted to be more like the character(s).

The last variable, parasocial interaction, showed that there were no significant findings when comparing recollection and recall of the topic with parasocial interaction. However, there was a significant difference of the means when looking at parasocial interaction and interest. This finding suggests that the more people have a parasocial interaction with characters, the more interesting they find the scientific topic. The same applies to parasocial interaction and personal relevance. The more parasocial interaction takes place, the more people find the scientific topic relevant for them personally. Parasocial interaction, to sum it up, does correlate with interest and personal relevance. No assumptions can be made, however, about the correlation with recollection and recall of the topic.

In general, this empirical study was not able to detect significant correlations between character involvement and knowledge gain. We can therefore make no assumption if involvement with characters leads to a gain in knowledge. What could be shown with this experiment was that wishful identification and parasocial interaction can lead to a sparked interest in the scientific topic. Also, parasocial interaction can convince viewers of a personal relevance of the scientific topic.

It was also part of the study to look at the correlation between character involvement and attitudes. Liking and attitudes did not show any significant correlation. The same can be said about the concept of similarity and attitudes. The correlations between attitudes and wishful identification/parasocial interaction might have been weak, but nonetheless significant. This means that the more people wish to be like character(s) and have parasocial relationships with them, the more positive attitudes they have towards science.

To sum up character involvement, it cannot be stated that there are significant effects of it towards knowledge gain and attitudes. Results could be, however, achieved with wishful identification and parasocial interaction. For this study, this means we can say that wishful identification and parasocial interaction can lead to positive attitudes and sparked interest (and personal relevance). For knowledge gain itself (recollection and recall), no assumptions can be made. Also, no effects could be proven with similarity and liking. The research

question concerning character involvement and effects can therefore only be partially answered.

Q3: Which effects has Edutainment on people from different social classes?

When looking at social class via educational levels, it becomes clear that, in terms of knowledge, people with a higher education tend to have more knowledge gain than viewers with a lower education. More people of higher education remembered the topic being mentioned in the programmes and more could state facts about Schroedinger's Cat.

This only supports the statements of Wood (2011:12f.) that educational achievement is related to social class and prosperity. As wealthier people tend to have higher educational achievements, they are more prone to educational messages in general. People from lower social classes remain disadvantaged in the education system (Wood, 2011:12f.).

Nevertheless, this master's thesis' aim was to look at differences due to Edutainment messages. Starting with recollection, the mean of participants of the TV series was higher (1.94) than of the scientific programme (1.75) and the general sample (1.82). These differences in means are significant (and a trend with the TV series). We can therefore say that although people with higher educational levels scored higher in recollection, the TV series helped people with lower educational levels to score better results.

As said before, there is a positive correlation between recall and education. We can say that the higher the education the more facts about Schroedinger's Cat could be remembered. Just looking at the lower educational levels, the viewers of the scientific programme scored worse results than the general sample (significant) and the viewers of the TV series scored higher results. Unfortunately, the difference in means of the TV series is not significant. The same applies to sparked interest as no significant results were achieved here. Only the mean of the scientific programme was significant and also the lowest compared to the general sample and the TV series.

People of lower education found the scientific topic more relevant than viewers with higher education (significant for the general sample and the scientific programme). It would be the same for the TV series, but the outcome is not significant.

In summary, people with lower education tended to score better results with the TV series in comparison to the general sample and the scientific programme. However, people with higher education still scored the best results in general. Only personal relevance had better means in the group of lower educational levels.

Observing education and attitude, it can be said that the higher the educational level, the more positive the attitude is towards science. However, no significant outcomes could be measured about the correlation.

These outcomes also apply to the TV series and the scientific programme, respectively (TV series is a trend). There were no significant results comparing means of attitudes in correlation with educational levels according to a t-test (general sample = 0.199, TV series = 0.905, scientific programme = 0.251).

Q4: Which effects has Edutainment on people in relation to gender?

The last research question was concerned with the correlation of Edutainment and gender. Even though females tend to work less often in the field of science, there is no difference of results concerning gender, according to the literature analysis. Nevertheless, there is a tendency of girls disliking scientific themes, and they therefore show lesser engagement and motivation, as well as lower self-esteem when it comes to their performance (OECD, 2012:6). The OECD (2016:6) found out that this is linked to underestimating their capabilities rather than to differences in achievements. It was therefore of interest if women actually scored worse than men. Due to an uneven distribution of gender in this study, not a lot of significant results could have been obtained. The TV series would have scored the best results with female watchers, however, no general conclusion can be drawn here. However, it can be said that the findings of gender and personal relevance were significant for the general sample and the TV series. Male participants saw more personal relevance in the scientific topic in both categories. Female watchers had higher values with the TV series. This proves the findings of the literature analysis, that fewer women take up science options (UNESCO, 2010:54) and that they have fewer self-esteem when it comes to science. If they do not see a personal relevance in a scientific topic, they would not want to choose science as a career. However, seeing that they scored better with an Edutainment message, this could mean that their attitude towards science could be increased. Unfortunately, measuring attitudes towards science itself, no significant outcomes could be achieved.

In summary, the only outcome concerning gender was that males had higher values in personal relevance compared to females, however, the TV series showed higher outcomes than the general sample.

9. Conclusion and outlook

In conclusion, Edutainment messages had a positive influence on remembering the scientific topic being part of the programme. Also, viewers could remember more facts about this topic after an exposure to the Edutainment programme. They were also more interested in the topic and saw more personal relevance of it. While most viewers of the scientific programme said that they did not remember anything at all about the topic, watchers of the TV series stated that they understand the concept of Schroedinger's Cat because of their (prior) exposure to the TV series. Edutainment does have in fact a positive effect on knowledge gain, according to this empirical work. For further studies, it would be interesting to see if people retained more knowledge after the exposure of an Edutainment programme as well. As the literature research showed, knowledge is only useful if it can be retained and remembered over a long period of time (Hunt, 2003:102). Therefore, a next step in this experimental procedure could be a longitudinal analysis of knowledge gain and Edutainment programmes.

Looking at attitudes in connection with Edutainment messages, it can be confirmed that attitudes towards science were higher after watching the TV series. As this study concentrated merely on the aspects of knowledge gain and attitudes, it would be interesting to see if actual behaviour change could be measured after an exposure to an Edutainment programme. It can be suggested to carry out a longitudinal study concerning young people just about to make career decisions or unemployed people wanting to break new grounds to see if positive attitudes because of Edutainment can lead to actual engagement with science.

Another outcomes was that participants watching the TV series experienced more transportation. It was proven that this narrative involvement leads to remembering more facts about the scientific topic, to more interest towards it, and to more personal relevance of it. Additionally, it was shown that narrative involvement is linked with more positive attitudes towards the scientific topic.

In future studies, programmes could be investigated that are more of a cross between the two programmes. As "The Big Bang Theory" was on the one extreme with highly entertaining elements and "Terra X Lesch & Co" on the other extreme with highly educational elements, it would be interesting to evaluate a programme that is more balanced. It can be investigated if a programme that tries to implement three-act structures into a scientific programme can also have effects of transportation and therefore leading to knowledge gains and changes in attitudes.

Character involvement, on the other hand, only achieved mixed results. There is a slight tendency that people who watched the TV series experienced wishful identification with the character(s). However, it was in fact evident that viewers of the TV series experienced more parasocial interaction with the character(s). With regard to wishful identification, it can be said it had a positive effect on sparked interest in the topic. The same is true for parasocial interaction. The more people were engaged with characters in a parasocial relationship, the more interest they showed in the scientific topic. Also, they found the topic more personally relevant. In the case of a positive attitude because of character involvement, it can be stated that wishful identification and parasocial interaction have led to more positive attitudes towards science. For further studies, it can be suggested to use scientific programmes that use a lesser relatable (and likeable) character as Harald Lesch to see if there are significant differences.

Social class was measured with the educational level and it showed that the more educated people were, the more knowledge gain they experienced. This does not necessarily surprise and therefore, this study looked at the influence of Edutainment messages on knowledge gain. In the case of remembering the topic being part of the programme, the viewers of the TV series with lower educational levels had higher values than the general sample and the scientific programme. When it comes to recollection of the facts about Schroedinger's Cat, it can be said that the viewers of the scientific programme with lower educational levels scored worse than the general sample. The same applies to sparked interest. Viewers of the scientific programme with less education scored the lowest results. It is interesting to notice that people with lower education found the scientific programme more relevant than people with higher education. Viewers of the scientific programme found the topic less relevant than the general sample

Looking at education and attitude, it can be said that the higher the educational level, the more positive the attitude is towards science. For future studies, a bigger sample of different educational levels might score better results in terms of significance.

Likewise, gender was unfortunately not evenly distributed in the sample. For that reason, few results were obtained. However, it was evident that male participants saw more personal relevance in the scientific topic than female participants. Female watchers had higher values with the TV series than in the general sample. More empirical work is needed here to see if results would be more significant with an even distribution between genders.

10. Appendices

10.1. Abstract

Das Ziel dieser Magisterarbeit war es, die Wirkung von Edutainment in der Wissenschafts-lehre zu untersuchen. Edutainment setzt sich aus den Wörtern Bildung und Unterhaltung zusammen und beschreibt einen theoriebasierten Kommunikationsprozess, bei dem bildungsrelevante und soziale Themen in Unterhaltungsprodukte implementiert werden. Da Wissenschaft für die Entwicklung unserer Welt essentiell ist, müssen sich mehr Menschen wissenschaftlicher Tätigkeit widmen. Tatsächlich aber sinkt die Zahl der wissenschaftli-chen Berufsausübenden, wobei besonders Frauen und Menschen aus bildungsfernen Schichten unterrepräsentiert sind. Daher wurde untersucht, inwiefern Edutainment einen Einfluss auf Wissenserwerb und positive Einstellungen zu Wissenschaft ausüben kann, da beide Komponenten unerlässlich für einen Verhaltenswandel sind. Die empirische Stu-die umfasste als Stimulusmaterial eine Episode von „The Big Bang Theory", in der das wissenschaftliche Thema „Schrödingers Katze" erklärt wird. Verglichen mit den Ergebnis-sen der reinen Bildungsserie „Terra X Lesch & Co" sollte so gezeigt werden, ob Wissens-zuwachs und positive Einstellungen zu Wissenschaft auf Edutainment zurückzuführen sind. Der theoretische Hintergrund empfahl den Fokus auf publikumszentrierte Theorien, da Narrative Involvement und Character Involvement Wissen und Einstellungen positiv beeinflussen. Ein experimenteller Fragebogen wurde ausgeführt, bei dem Konzepte wie Transportation, Identification, Wishful Identification, Liking und Parasocial Interaction mit-eingebunden wurden. Die Ergebnisse der Studie haben unter anderem gezeigt, dass Edu-tainment und Narrative Involvement eine positive Wirkung auf Wissenserwerb und Einstel-lungen zu Wissenschaft haben.

The aim of this master's thesis was to evaluate the effects Edutainment messages can have in science teaching. Edutainment is a portmanteau word composed of the terms ed-ucation and entertainment and describes a theory-based communication process where educational and social issues are intentionally integrated in the development and produc-tion of an entertainment product. As science is essential to ensure development of our world, more people should engage in scientific activities. However, the number of profes-sionals trained in science is declining, and especially women and lower classes are un-derrepresented in this field of study. It was therefore investigated whether Edutainment can influence knowledge gain and positive attitudes towards science, as both processes

are essential to trigger behavioural change. The empirical research conducted was focused on an episode of "The Big Bang Theory", where the scientific topic of Schroedinger's Cat was explained. As a contrast, a purely educational programme was chosen (Terra X Lesch & Co) to show if gains in knowledge and positive attitudes can be linked to Edutainment messages. According to the theoretical framework of Edutainment, audience-centred theories like narrative and character involvement can influence knowledge gain and attitudes. The experimental survey conducted thus included theoretical concepts like transportation, identification, wishful identification, liking, and parasocial interaction. The results of this empirical work was, among others, that Edutainment and narrative involvement have a positive effect on knowledge gain and positive attitudes towards science.

10.2. Transcription

Transcription of The Big Bang Theory, episode 17, season 1, "Schrödingers Katze"

12:19	Penny	Okay, also die Sache ist die. Du weißt ja sicher, dass Leonard mit mir ausgehen will.
12:26	Sheldon	Also gesagt hat er eigentlich nichts, aber als er in die Wohnung zurückkam, begann er zu tanzen als wäre eins der glücklichen Flusspferde aus Fantasia.
12:34	Penny	Oh, das ist süß. Na jedenfalls wollte ich mit dir über Folgendes reden. Du weißt schon, seit ich mit Leonard befreundet bin, war ich... Setz dich doch!
12:43	Sheldon	Oh, ich wünschte, es wäre so einfach. Da ich nämlich nicht sehr viel Zeit hier verbringe, habe ich noch keinen idealen Sitzplatz für mich ausgewählt.
12:51	Penny	Dann tu das jetzt.
12:52	Sheldon	Tja, es gibt da eine Vielzahl an Optionen und meine Informationen über die Dichte der Polster, das Luftströmungsprofil und die Streuung des Sonnenlichtes sind für eine fundierte Entscheidung nicht ausreichend.
13:03	Penny	Setz dich irgendwo hin und wenn es dir da nicht gefällt, setzt du dich das nächste Mal woanders hin.
13:07	Sheldon	Nein, nein, das ist verrückt. Fang ruhig an zu reden während ich nach einer Lösung suche.
13:15	Penny	Okay. Also es geht darum, ich weiß schon seit einer ganzen Weile, dass Leonard vielleicht ein klein wenig für mich schwärmt.
13:23	Sheldon	Ein klein wenig nur? Ja, wahrscheinlich ungefähr so, wie Minnelaos für Helena von Troja ein klein wenig geschwärmt hat.
13:32	Penny	Na gut, ich kenne die beiden zwar nicht, aber...
13:34	Sheldon	Minnelaos war der Bruder von...
13:35	Penny	Ja, ist egal, ist egal. Hör zu, der springende Punkt ist, dass Leonard nicht gerade zu denen gehört, mit denen ich je ausgehen würde.
13:42	Sheldon	Leonard gehört nicht zu denen, mit denen irgendjemand ausgehen würde. Wärst du bereit, die Couch um 30° im Uhrzeigersinn zu drehen?
13:49	Penny	Nein. Damit will ich sagen, dass Leonard vielleicht auf eine erfreuliche Art anders ist. Mein bisheriges Auswahlverfahren hat ja wohl nicht so gut funktioniert.
13:58	Sheldon	Das würde Koothrappali ganz anders sehen, er hat jetzt einen iPod. Oh, wie grell!
14:06	Penny	Aber andererseits setze ich eine wirklich gute Freundschaft aufs Spiel, wenn es mit Leonard nicht hinhaut. Er wird doch nicht auf eine flüchtige Affäre aus sein, er gehört zu denen, die sich über Lichtjahre binden, um es mit deinen Worten zu sagen.
14:17	Sheldon	Das würde ich nicht sagen, niemand würde das sagen. In Lichtjahren wird die Entfernung gemessen, nicht die Zeit.
14:22	Penny	Danke für die Aufklärung.

14:32	Sheldon	Es zieht. Da hört jemand das Wort Jahr und denkt gleich an Zeitdauer. Du würdest Liebeskummer ja höchstwahrscheinlich auch nicht in Kilohertz messen.
14:40	Penny	Genau, danke.
14:42	Sheldon	Den Fehler machen viele.
14:43	Penny	Das ist heute nicht mein erster gewesen.
14:46	Sheldon	Okay... Ich denke, das wird mein Platz.
14:51	Penny	Sheldon, hast du irgendetwas zu sagen, was irgendetwas mit dem zu tun hat, worüber ich gerade spreche?
14:56	Sheldon	Mal sehen. Betrachten wir doch einmal Schrödingers Katze.
15:02	Penny	Schrödinger... Ist das die Frau aus 2A?
15:04	Sheldon	Nein, das ist Mrs. Grossinger, und sie hat keine Katze, sondern einen mexikanischen Nackthund, nerviges Biest.
15:09	Penny	Sheldon!
15:12	Sheldon	Entschuldige, du hast mich abgelenkt. Wie auch immer. 1935 hat Erwin Schrödinger bei dem Versuch die Kopenhagener Deutung der Quantenphysik zu erklären, ein Experiment vorgeschlagen, bei dem eine Katze in eine Kiste gesperrt wird, zusammen mit einer versiegelten Giftampulle, die irgendwann zerbrechen würde. Gut, da niemand weiß, wann oder ob das Gift freigesetzt wurde, bevor die Kiste geöffnet wird, kann die Katze gleichzeitig als beiden angesehen werden, lebendig und tot.
15:42	Penny	Ich verstehe nicht, worauf du hinaus willst.
15:45	Sheldon	Natürlich nicht, dazu komme ich doch erst noch. Du müsstest schon hellsehen können und as ist ausgeschlossen.
15:51	Penny	Was willst du mir sagen?
15:54	Sheldon	Genau wie bei Schrödingers Katze kann deine mögliche Beziehung mit Leonard gerade jetzt als beides angesehen werden, als gut und ebenso als schlecht. Erst durch das Öffnen der Kiste wirst du herausfinden, was zutrifft.
16:04	Penny	Okay... Du willst also sagen, ich sollte mit Leonard ausgehen.
16:08	Sheldon	Nein, nein, nein. Also nochmal von vorne. 1935 hat Erwin Schrödinger...

Transcription of Terra X Lesch & Co, episode „Schrödingers Katze – tot oder lebendig?"

00:00	Lesch	Ich habe heute einen Gast, oder eine Gästin, das weiß ich gar nicht so genau. Eine der berühmtesten Katzen der Welt. Die Katze von Erwin Schrödinger. Die Frage ist: Lebt sie noch? Ist sie schon tot? Oder ist sie immer noch in dem Bereich irgendwo dazwischen?
00:21	Lesch	Ja hier, ich mach sie gleich auf, komm, ich mach es kurz und bündig. Erwin Schrödinger, großer Physiker, einer der Begründer der Quantenmechanik, hatte sich vor etlichen Jahrzehnten folgende Gedanken gemacht. Wenn ich in so einem Kasten ein radioaktives Element drinnen hätte, also ein radioaktives chemisches Element, das kann zerfallen, und durch den Zerfall wird ein Hammer dazu veranlasst werden, eine Phiole mit Gift zu zertrümmern. Und die Katze, die hier in

		dem Kasten ist, die würde dann eben entsprechend sterben. Das Finale wäre auf jeden Fall, wenn ich nur lang genug warte, dass die Katze tot ist. Aber in welchem Zustand ist die Katze?
01:02	Lesch	Denn, es gibt ein großes Problem. Der radioaktive Zerfall, das ist ein quantenmechanischer Prozess. Der kann passieren, muss aber noch nicht. Also es gibt da so einen Zwischenzustand der Verschränkung des Sowohl als auch. Und das ist ja irgendwie inzwischen klar. Also beim radioaktiven Zerfall ist es so, ich kann bei einem Atomkern gar nicht genau sagen, wann der zerfällt. Wenn ich aber genügend von diesen Atomkernen habe, dann kann ich eine genaue, ziemlich genaue Bestimmung der Halbwertszeit vornehmen, das heißt, das ist die Zeit in der die Hälfte der vorhandenen Atomkerne zerfallen ist. Muss man sich natürlich fragen, woher weiß der Atomkern das, dass die anderen auch noch da sind? Also wieso zerfällt er nicht einfach in der Halbwertszeit, sondern nur statistisch? Wieso ist das so?
01:52	Lesch	Das ist eben genau dieses quantenmechanische Unbestimmtheitselement, was zu so vielen geheimnisvollen Fragen geführt hat, unter anderem eben dann, von Erwin Schrödinger, und er wollte im Grunde genommen nur darauf hinweisen, wie absurd das ist, was in der Quantenmechanik so erfolgreich Naturphänomene erklären kann. Was sie erklären kann, das erkläre ich gleich noch. Aber er hat gesagt, okay, ich habe also die Unbestimmtheit, die Verschränkung in dem radioaktiven Zerfall, wenn ich jetzt die Katze dazu nehme und das ganze Dinge wieder verschlösse, wäre dann die Katze ihrerseits eben auch verschränkt? Und dann kann man eben sagen, welche Zustände kann die Katze haben? Sie lebt, sie lebt nicht, ja wie jetzt, und dazwischen? Was soll denn das für ein Dazwischen-Zustand sein?
02:38	Lesch	Ist man überhaupt drauf gekommen, dass es solche verschränkten Zustände geben muss. Im Grunde genommen kann man, naja, was soll man nehmen, nehmen wir das Allereinfachste, die Frage, wieso gibt es uns überhaupt? Ja klar, Anfang des 20. Jahrhunderts hat man herausgefunden, dass das Atom aus einem positiv geladenen Atomkern besteht und dass diese positiv geladenen Atomkerne von negativ geladenen Elektronen umkreist werden. Und damals, also zu dieser Zeit als es diese ganze Quantenmechanik mit ihren beschränkten und verschränkten Zuständen noch nicht gab, da hatte man ein Riesenproblem. Denn, ungleichnamige Ladungen ziehen sich an. Und da das Elektron viel leichter ist als das Proton im Atomkern, müsste eigentlich das Elektron allmählich, und zwar ziemlich schnell, gar nicht so allmählich, in den Kern hineinsausen, würde dadurch beschleunigt, durch den Anwesenheit des Atomkerns würde das Elektron beschleunigt, beschleunigte Ladung strahlt ab, würde noch schneller hineinfallen, wäre also praktisch wie ein Sender. Ja, was würde da herauskommen, irgendeine Form von Materie, auf jeden Fall sehr kompakt. So, das würde es also auf keinen Fall geben, denn Moleküle zum Beispiel, da verbin-

		den sich ja Atome, das hatte man alles erst viel später erfahren, aber es war einem schon klar, hier muss etwas ganz anderes, also das Elektron kann nicht einfach nur was sein, was so ein Teilchen ist, was da in einer bestimmten Bahn um den Kern herum sich verhält, sondern am Anfang hat man Verbotszonen definiert. Hat man gesagt, so, das Elektron kann nur da sein. Und nur da. Und da auch, aber sonst nicht. Und schon gar nicht im Kern, das durfte nicht sein. Das heißt man ahnte schon, und zwar ohne es direkt auszusprechen, dass die einfache Definition „das Elektron sei ein Teilchen und nur ein Teilchen, nichts als ein Teilchen", so wie dieser berühmte Satz, die Wahrheit, nichts als die Wahrheit, das könne nicht stimmen. Und in der Tat gibt es ein berühmtes Experiment, das diesen Charakter, den Teilchen-Charakter des Elektrons doch sehr in Zweifel zog. Und zwar ziemlich früh.
04:36	Lesch	Dieses Experiment ist der berühmte Doppelspalt. Wir haben hier eine Maschine, aus der kommen Elektronen raus und dann haben wir hier einen Doppelspalt, das ist einfach nur, nichts anderes als zwei sehr enge Schlitze und hinten haben wir einen Schirm, und dann würden wir zum Beispiel einen fotoempfindlichen Schirm, jedes Mal wenn ein Elektron auf diesen Schirm trifft, bildet sich ein dunkler oder heller Punkt, je nachdem. So, was würde man denn erwarten? Wenn hier Teilchen starten, haben wir hier einen Spalt, haben wir da einen Spalt, also würden wir erwarten ein Maximum direkt hinter einem Spalt und ein Maximum direkt hinter dem anderen Spalt. Teilchen gehen da durch, Maximum, Maximum. Na, ist ja klar. Was sieht man? Etwas ganz anderes. Man sieht ein Indifferenzmuster, dessen Maxima auch noch genau da sind, wo man sie nicht erwartet. Also von wegen genau hinter dem Spalt, nichts da. Dazwischen. Als ob das Elektron und die Elektronen Wellen wären. Ja was denn nun, wir haben Elektronen losgeschickt, das sind doch Teilchen. Sie verhalten sich wie Wellen. Da liegt genau der Hund begraben.
05:45	Lesch	Da wurde dann überlegt, mein Gott, was für Zustände. Also das Elektron kann, also ist in einem Kann-Zustand, am Ende ist es in einem Muss-Zustand, es muss ja hier, damit es zu dieser Indifferenz kommt, eine Welle gewesen sein, usw. Und da beginnt dann der ganze Wahnsinn, eben zu dem auch Schrödingers Gedankenexperiment führen soll. Was haben wir denn hier vorne losgeschickt? Teilchen? Na Wellen? Man hat es auch andersrum probiert, man hat Wellen losgeschickt, mit Licht, ja kann man gucken. Und zwar hat man Wellen, zum Beispiel auf Metalloberflächen geschickt. Und hat dort festgestellt, diese elektromagnetischen Wellen, die verhalten sich gar nicht wie Wellen. Die verhalten sich wie Teilchen. Das ist der berühmte Fotoeffekt. Ja, also da wo man dachte es sind Wellen, da gibt es offenbar Teilcheneigenschaften. Und da, wo man dachte es sind Teilchen, da gibt es offenbar Welleneigenschaften. In dieser kleinen Welt, in dieser allerkleinsten Welt da unten, da scheint alles überhaupt nicht so klar zu sein. Also von wegen das ist da und das ist dort, klipp und klar zu sagen, es ist etwas an einem Ort, es ist etwas von dieser Art, sondern das scheint sich in

		so Zwischenzuständen zu befinden. Und so wäre das auch mit der Katze von Schrödinger gewesen. Die hätte sich in dem Zwischenzustand befunden, im Zwischenreich.
07:02	Lesch	Was ist das nun mit der Quanten- da hat sich eben in den letzten Jahren einiges geklärt. Und so könnte man jetzt sagen, von nun an beginnt die De-Mystifizierung der Quantenmechanik. Vergesst das alles mit dem Kollaps und irgendwelchen Wellenfunktionen, von irgendwelchen Vier-Welten-Theorien, usw. Schauen wir uns doch mal die Wirklichkeit an! Machen wir das Doppelspalt-Experiment, ja in einer nicht so isolierten Fassung irgendwo im Labor, sondern wir stellen es einfach irgendwohin, in einem Kasten und lassen diesen Kasten warm werden. Ja. So ist ein Experiment gemacht. Man hat den Kasten warm gemacht, da entsteht ja eben Wärmestrahlung. Und Wärmestrahlung, das muss man wissen, ist elektromagnetische Strahlung. Ja, elektromagnetische Strahlung, das kann sich auch verhalten wie Teilchen, das haben wir schon gehört. Also elektromagnetische Strahlung, das sind ja eigentlich elektromagnetische Wellen. Oder doch nicht? Nun, man hat den Begriff der Photonen dabei entdeckt. Oder man hat ihn erfunden. Ein Photon ist eine bestimmte Menge an Energie in Abhängigkeit ihrer Frequenz. Bei Wärmestrahlung sind das eben relativ lange Wellen, alle die schon mal mit so einem Infrarotgerät versucht haben, sich die Gelenke zu erwärmen, wissen wir was die Strahlung macht. Sie macht warm. Das heißt, die Strahlung bewegt sich von der Lampe auf den Körper und erhitzt dort die Teilchen. Das heißt es gibt eine Wechselwirkung. So, und jetzt kucken wir uns das Experiment an, inzwischen ist es warm geworden hier drinnen. Was ist denn aus dem Indifferenzmuster da hinten geworden? Komisch. Das Indifferenzmuster ist verschwunden. Man sieht ein Maximum hinter dem einen Spalt und man sieht ein Maximum hinter dem anderen Spalt. Gerade so, als wenn die Teilchen, die wir hier losgeschickt haben, auf der ganzen Reise durch den Spalt bis hin zu dem Fotoschirm da hinten Teilchen geblieben sind. Von den Welleneigenschaften ist gar nichts mehr da. Weg. Was ist da passiert? Ah, die Strahlung, genau. Die Strahlung hat nämlich mit den Elektronen auf dem Weg zum Spalt wechselgewirkt. Und die geisterhaften verschränkten quantenmechanischen Zustände sind durch jeden Zusammenstoß der Elektronen mit den Photonen, mit der elektromagnetischen Strahlung also, immer schwächer und schwächer geworden und je schneller das geht, je mehr Wechselwirkung es gibt, umso weniger quantenmechanische Eigenschaften sind noch sichtbar. Und am Ende ist alles klassisch, ta da. Das nennt man Dekohärenz. Dass man durch das Eindringen der Wirklichkeit in ein quantenmechanisches System sich diese scheinbaren verschränkten Zustände, von denen ich überhaupt nie was wissen kann bevor keine Wechselwirkung stattgefunden hat, die werden durch die Wechselwirkung sogar zerstört. Mit anderen Worten: Die Wirklichkeit macht aus der quantenmechanischen Wirklichkeit die klassische Wirklichkeit. Deswegen gibt es uns. Deswegen gibt es den Kasten. Und deswegen gibt es auch die Katze, die in Wirklichkeit in dem Kasten

		da drinnen als Vielteilchensystem mit sich so intensiv wechselwirkt, dass die Katze natürlich keine verschränkten Zustände hat. Es gibt keine Dazwischenkatze. Die Katze ist entweder tot oder lebendig.
09:54	Lesch	Die Anzahl der Wechselwirkungen definiert, ob ich in einer klassischen Welt bin, also Vielteilchensysteme, unser Gehirn, ist überhaupt nichts quantenmechanisches da oben, obwohl natürlich ständig Wechselwirkungen der Atome untereinander stattfinden. Aber diese Dekohärenz, das Verschwinden dieser verschränkten quantenmechanischen Zustände, ist so schnell, das von Quantenmechanik in unserem Leben gar nichts übrig bleibt. Denn die Quantenmechanik ist überall, sie ist nur nicht überall spürbar. Weil sie durch sich selber sozusagen teilweise auslöscht. Und nur so ist eine Welt möglich, in der wir zwischen Ursache und Wirkung unterscheiden können, in der wir sagen können, das ist da und das ist da. In dem wir nicht durch die Wand gehen können, usw. Die Quantenmechanik ist die Bedingung der Möglichkeit Mensch zu sein. Aber Mensch zu sein ist etwas ganz anderes als nur reine Quantenmechanik.
10:40	Lesch	Die Quantenmechanik ist eine Theorie, eine mathematische Theorie, die extrem erfolgreich ist. Man denke nur daran, welche technologischen Auswirkungen sie zur Folge hatte. Aber sie beschreibt eine Welt, die mit uns fast nichts zu tun hat. Und am Ende wird wahrscheinlich nur Nils Bohr noch einen retten können, der mal gesagt haben soll, der hat viel gesagt, aber soll mal gesagt haben: Wer behauptet die Quantenmechanik verstanden zu haben, der hat sie nicht verstanden.

Fragebogen

Sie werden nun ein paar Fragen zur soeben gesehenen Folge gestellt bekommen. Alle Angaben sind anonym. Versuchen Sie, die Fragen so ehrlich wie möglich zu beantworten. Es gibt keine richtigen oder falschen Antworten.

Bitte beantworten Sie zuerst ein paar Fragen zu Ihrer Person.

Ich bin............ Jahre alt.

männlich	weiblich	sonstiges

Meine höchste abgeschlossene Ausbildung:

Pflichtschule	Berufsbildende mittlere Schule/Lehre	AHS (z.B.) Gymnasium	Berufsbildende höhere Schule, mittlere Schulen für das Gesundheitswesen	Fachlehrgang oder Kolleg mit Hochschulcharakter	Hochschulabschluss

Beruflich bin ich...

....

In der Serie „The Big Bang Theory" erwähnte Sheldon das Gedankenexperiment „Schrödingers Katze".

Können Sie sich noch daran erinnern?

ja	nein

Können Sie kurz beschreiben, worum es dabei ging? Schreiben Sie so viele Informationen dazu auf, die Ihnen einfallen.

....

....

....

Können Sie sich sonst noch an naturwissenschaftliche Fakten erinnern?

....

....

Finden Sie das Gedankenexperiment interessant?

ja	nein

War das Gedankenexperiment für Sie persönlich relevant?

ja	nein

Haben Sie von dem Gedankenexperiment schon vorher mal etwas gehört?

- o *Nein, aber jetzt verstehe ich es gut.*
- o *Nein, und ich verstehe es auch jetzt noch nicht wirklich./Ja, und ich verstehe es auch jetzt noch nicht wirklich.*
- o *Ja, ich habe die Folge schon mal gesehen und seitdem verstehe ich das Gedankenexperiment.*
- o *Ja, ich habe das Gedankenexperiment schon vor The Big Bang Theory gekannt und gut verstanden.*

Was denken Sie allgemein über Wissenschaft und Wissenschaftler/innen?

	Ich stimme vollkommen zu	Ich stimme zu	Ich bin mir nicht sicher	Ich stimme nicht zu	Ich stimme überhaupt nicht zu
Wissenschaftler/innen engagieren sich mehr für die Wissenschaft als für Ihre Familien.					
Wissenschaftler/innen sind unfreundlicher als andere Menschen.					
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Wir müssen Experimente nicht wiederholen um zu überprüfen, ob die Ergebnisse korrekt waren.					
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Es wird zu viel Geld für Wissenschaft ausgegeben, das für bessere Zwecke eingesetzt werden könnte.					
Geld, das für die Wissenschaft verwendet wird, ist gut investiert.					
Wissenschaft hilft dabei, das Leben zu verbessern.					
Es sollte mehr Geld für die wissenschaftliche Forschung ausgegeben werden.					

Nun ein paar Fragen zur Geschichte selbst.

	Ich stimme vollkommen zu	Ich stimme zu	Ich bin mir nicht sicher	Ich stimme nicht zu	Ich stimme überhaupt nicht zu
An manchen Stellen fiel es mir schwer zu verstehen, was in der Folge vor sich ging.					
Manche Charaktere finde ich nicht nachvollziehbar.					
Es fiel mir schwer, den roten Faden der Geschichte zu erkennen.					
Ich bin gedanklich abgeschweift, während ich die Folge geschaut habe.					
Während ich die Folge geschaut habe, habe ich über andere Dinge nachgedacht.					
Es fiel mir schwer, gedanklich bei der Geschichte zu bleiben.					
Während ich die Folge geschaut habe, war mein Körper physisch zwar im Raum anwesend, gedanklich war ich aber mitten in der Welt der Serie.					
Die Serie hat eine neue Welt geschaffen, die plötzlich verschwunden ist, als die Folge zu Ende war.					
Während ich die Folge gesehen habe, war mir die fiktive Welt manchmal näher als die reale Welt.					
Die Geschichte hat mich emotional berührt.					
Ich habe mich gefreut, als einer der Charaktere erfolgreich war. Ich war traurig, als es einem der Charaktere schlecht ging.					
Manche der Charaktere haben mir leidgetan.					

Denken Sie nun an einen Charakter aus der Serie, der Ihnen in Erinnerung geblieben ist. Ich wähle:

....

Finden Sie ihn/sie sympathisch?

ja	nein

Dieser Charakter...

	1	2	3	4	5	6	7	
... ist nicht so wie ich.								... ist so wie ich.
... ist anders als ich.								... ist mir ähnlich.
... denkt nicht wie ich.								... denkt wie ich.
... benimmt sich nicht wie ich.								... benimmt sich wie ich.
... hat einen anderen sozialen Status.								... hat den gleichen sozialen Status.
... gehört einer anderen sozialen Klasse an.								... ist von der gleichen sozialen Klasse.
... ist kulturell anders als ich.								... ist mir kulturell ähnlich.
... ist nicht in der gleichen wirtschaftlichen Lage.								... ist in der gleichen wirtschaftlichen Lage.

Denken Sie weiterhin an diesen Charakter.

	Ich stimme vollkommen zu	Ich stimme zu	Ich bin mir nicht sicher	Ich stimme nicht zu	Ich stimme überhaupt nicht zu
Der Charakter ist eine Person, die ich auch gerne wäre.					
Manchmal wünsche ich mir, ich wäre mehr wie der Charakter.					
Der Charakter ist jemand, dem ich nacheifern möchte.					
Ich möchte auch Dinge machen, die der Charakter in der Serie macht.					
Ich möchte nie so handeln wie der Charakter es in der Serie tut.					

	Ich stimme vollkommen zu	Ich stimme zu	Ich bin mir nicht sicher	Ich stimme nicht zu	Ich stimme überhaupt nicht zu
Ich würde mitfühlen, wenn der Charakter einen Fehler macht.					
Ich fühle mich wohl mit dem Charakter, so wie mit meinen Freunden.					
Ich sehe den Charakter als eine natürliche, bodenständige Person.					
Ich würde mich freuen, den Charakter in der nächsten Episode wieder zu sehen.					
Wenn man den Charakter in einem anderen TV-Programm sehen würde, dann würde ich es schauen.					
Der Charakter versteht die Dinge, über die ich gerne Bescheid wissen möchte.					
Wenn es einen Bericht über den Charakter in einer Zeitschrift geben würde, würde ich ihn lesen.					
Ich würde den Charakter vermissen, wenn er/sie nicht in der Serie dabei wäre.					
Ich würde den Charakter gerne im echten Leben treffen.					
Ich finde den Charakter attraktiv.					

Vielen Dank für die Teilnahme.

Fragebogen

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Beruflich bin ich...

....

In dem Wissenschaftsmagazin nennt der Präsentator das Gedankenexperiment „Schrödingers Katze".

Können Sie sich noch daran erinnern?

ja	nein

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....

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....

....

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Wissenschaftliche Errungenschaften schaden mehr als sie Gutes tun.					
Es wird zu viel Geld für Wissenschaft ausgegeben, das für bessere Zwecke eingesetzt werden könnte.					
Geld, das für die Wissenschaft verwendet wird, ist gut investiert.					
Wissenschaft hilft dabei, das Leben zu verbessern.					
Es sollte mehr Geld für die wissenschaftliche Forschung ausgegeben werden.					

Nun ein paar Fragen zur Geschichte selbst.

	Ich stimme vollkommen zu	Ich stimme zu	Ich bin mir nicht sicher	Ich stimme nicht zu	Ich stimme überhaupt nicht zu
An manchen Stellen fiel es mir schwer zu verstehen, was in der Sendung vor sich ging.					
Den Präsentator finde ich nicht nachvollziehbar.					
Es fiel mir schwer, den roten Faden der Sendung zu erkennen.					
Ich bin gedanklich abgeschweift, während ich die Sendung geschaut habe.					
Während ich die Sendung geschaut habe, habe ich über andere Dinge nachgedacht.					
Es fiel mir schwer, gedanklich bei der Geschichte zu bleiben.					
Während ich die Sendung geschaut habe, war mein Körper physisch zwar im Raum anwesend, gedanklich war ich aber mitten in der Welt der Sendung.					
Die Sendung hat eine neue Welt geschaffen, die plötzlich verschwunden ist, als die Folge zu Ende war.					
Während ich die Sendung gesehen habe, war mir die präsentierte Welt manchmal näher als die reale Welt.					
Die Sendung hat mich emotional berührt.					
Ich würde mich freuen, wenn der Präsentator Erfolg hat. Ich wäre traurig, wenn es dem Präsentator schlecht ginge.					
Der Präsentator hat mir leidgetan.					

Denken Sie nun an den Präsentator.

Finden Sie ihn sympathisch?

ja	nein

Dieser Charakter...

	1	2	3	4	5	6	7	
... ist nicht so wie ich.								... ist so wie ich.
... ist anders als ich.								... ist mir ähnlich.
... denkt nicht wie ich.								... denkt wie ich.
... benimmt sich nicht wie ich.								... benimmt sich wie ich.
... hat einen anderen sozialen Status.								... hat den gleichen sozialen Status.
... gehört einer anderen sozialen Klasse an.								... ist von der gleichen sozialen Klasse.
... ist kulturell anders als ich.								... ist mir kulturell ähnlich.
... ist nicht in der gleichen wirtschaftlichen Lage.								... ist in der gleichen wirtschaftlichen Lage.

Denken Sie weiterhin an den Präsentator.

	Ich stimme vollkommen zu	*Ich stimme zu*	*Ich bin mir nicht sicher*	*Ich stimme nicht zu*	*Ich stimme überhaupt nicht zu*
Der Präsentator ist eine Person, die ich auch gerne wäre.					
Manchmal wünsche ich mir, ich wäre mehr wie der Präsentator.					
Der Präsentator ist jemand, dem ich nacheifern möchte.					
Ich möchte auch Dinge machen, die der Präsentator in der Sendung macht.					
Ich möchte nie so handeln wie der Präsentator es in der Sendung tut.					

	Ich stimme vollkommen zu	Ich stimme zu	Ich bin mir nicht sicher	Ich stimme nicht zu	Ich stimme überhaupt nicht zu
Ich würde mitfühlen, wenn der Präsentator einen Fehler macht.					
Ich fühle mich wohl mit dem Präsentator, so wie mit meinen Freunden.					
Ich sehe den Präsentator als eine natürliche und bodenständige Person.					
Ich würde mich freuen, den Präsentator in der nächsten Sendung wieder zu sehen.					
Wenn man den Präsentator in einem anderen TV-Programm sehen würde, dann würde ich es schauen.					
Der Präsentator versteht die Dinge, über die ich gerne Bescheid wissen möchte.					
Wenn es einen Bericht über den Präsentator in einer Zeitschrift geben würde, würde ich ihn lesen.					
Ich würde den Präsentator vermissen, wenn er nicht in der Sendung dabei wäre.					
Ich würde den Präsentator gerne im echten Leben treffen.					
Ich finde den Präsentator attraktiv.					

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12. Table of figures