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# MASTERARBEIT

Titel der Masterarbeit

## ENCOUNTERING SCIENCE IN A SITCOM

## How „The Big Bang Theory“ stages science


Verfasserin

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# 1. Introduction

The way science and technology are approached has changed in recent years. Research, as well as applied science, is publicly discussed, findings are published outside of professional journals and scientists have to engage in communicating their research to the public. The public has become more interested in science. They consume, share and question the information they are provided with. On the other hand, science and technology have become more industrialized; they create jobs and have to pull in sales. Science and technology are used to gain knowledge which can be applied, patented and turned into a marketable product. The growing demand and use of science and technology has not just changed the application of science and technology and its perception, it has also affected the way science and technology is being communicated.

In times when laboratories were to be found in the houses of well situated gentleman, the purpose of science communications was to legitimize science/experiments rather than to educate the audience (Shapin 1990). Lay people (people without further education in the specific scientific field) who witnessed experiments would give the scientists credibility and the reputation they would gain from performing experiments, would feed into their profile as scientists. Nowadays, experiments are performed without audiences and the validation of scientific research is not based on a lay audience, but rather on a specialized audience which is familiar or acquainted with the research. Yet, the engagement of lay people is still crucial in science, technology and research as a means of marketing, publication, justification etc. (Bucchi 2008).

Communication is increasingly spread amongst various channels; as information is set to reach as many people as possible. The opportunities to directly address as well as to interact with the audience allow for science and technology to be presented on television, online media, as well as in magazines and newspapers. The way scientists engage in science communication has changed as well. While scientist - public interactions used to be in the form of a senior researcher participating in a podium discussion (Jensen 2011; The Royal Society 2006), nowadays researchers and scientists exposed to the public are more varied in reputation, engagement, skills and age (Jensen 2011). Also their engagement is not limited to one format. While they still participate in podium discussions they also attend TV interviews or write blogs etc.

The format of the communication is dependent on its target audience and the target audience for science and technology is increasing which is why the efforts are becoming more popularized, more colorful, more “fun”. Some of them are aimed at children, some at people without particular interest in science, some aim at elderly people and others try to engage people with advanced educational background in science as well.

Science communication has become an important part of promotion and marketing, not just for the sake of science itself but especially for the entities involved like universities, institutions and industry (Bucchi 2008). Getting people interested in science provides them with both potential employees as well as potential customers. Informing people about new developments in the field of science and technology is a way of raising awareness. This attention can then be used to promote certain issues but there are also far more other interests at hand.

Science communication efforts often range from a note in the newspaper announcing the discovery of a new drug to a televised interview with a Nobel Prize winner in Physics, to a radio feature on a research group or a blog entry on a new book about the science of football etc. The topics and formats that feature issues related to science and technology are manifold, as are the reasons to engage in science communication.

Yet, it is not just the side of science and technology that is actively seeking the engagement of the public; the public itself is also becoming increasingly interested in educating themselves in topics and issues of science and technology. With the shift from information to knowledge society, the members have become more self-determined; they independently decide where to find and look for information as well as what to do with that information. The communication of science in this regard supports and feeds those efforts and is an essential part of empowering the public. This illustrates the fact that the communication of science is an increasingly important issue which needs to be addressed at different angles and levels.

My personal interest is rooted in science communication embedded in formats that do not primarily aim at educating its audience but rather at entertaining it, such as movies or entertainment television. As the focus of these media is humor and laughter, it seems interesting to have a look at how science and technology are used to tell stories and at how these stories are made more interesting, relatable or marvelous. The connection between storytelling and science is certainly very apparent in the genre of science fiction. This genre works with scientific notions, technological developments as well as futuristic settings as a means to explore society and politics on a more abstract level. However, science fiction does not necessarily show the “reality” however; it exaggerates true events and developments and invents scenarios of the future rather than it depicts current events in science and technology. It can be argued that series or movies do not depict reality either, as they are scripted and based on screenwriters’ perceptions of science and technology, yet most of the science and technology featured in those kinds of non-science fiction media would be based on “templates” depicting factual knowledge.

Feature films have already been in the center of attention of various studies that looked at completely different angles of science and its embedding in movies. Kirby has looked into the role of science consultants (Kirby 2003a; Kirby 2003b; Kirby 2011) as well as into how movies shape the development of future developments (Kirby 2010). Others have looked into the stereotypes of scientists shown in movies (Haynes 2003; Losh 2010; Weart 1988). Also, there are several publications dealing with gender stereotypes in movies as well (Long, Boiarsky, and Thayer 2001; Flicker 2003; Chimba and Kitzinger 2010).

Television in this day and age is an important source of both entertainment and information. According to Statistik Austria, in 2012 about 3.3 million TV connections were being registered and paid for in Austria, reaching about 64% of the Austrian population ("STATISTIK AUSTRIA - Hörfunk Und Fernsehen" 2014), who are using their television at least once a day. The ORF (Österreichischer Rundfunk) is the national broadcaster in Austria, which theoretically every household with a television set and an antenna is able to receive. Considering that the ORF has an educational mandate, parts of their programing has to be devoted to the education and information of its viewers. Science Communication in this respect can be seen as a duty of national television. The way they opt for the communication of science is in form of various television magazines focusing on science as well as on more in depth analysis of certain topics in short news clips as well as making additional information available to their audience via other channels such as online articles or radio reports.

The content shown in science communication efforts by the ORF nevertheless fits into the categories of being rather "conventional". Conventional in the way that their emphasis is clearly on education, the segments or shows which feature scientific and/or technological content are designed to give information but do not emphasize on entertainment. Yet entertainment television has taken up on science and technology as well. There are numerous examples of series that have leading characters that are scientists (Crime Scene Investigation, Numbers, The Big Bang Theory, etc.) or feature science and/or technology as part of their storylines (Silicon Valley, The IT Crowd, etc…). Some of which have been the topic of various papers and essays already (Ley, Jankowski, and Brewer 2012; Bailey 2002; Guinnessy 2005).

The reason I am interested in entertainment television in particular is because it reaches people that might not watch specific television programs communicating science/technology on purpose. Those people might watch a series or sitcom featuring science and/or technology accidentally, but they want to be entertained and these kinds of programs can provide them with a mixture of both. The interesting thing about putting science, technology and entertainment into a genre like the sitcom is that the audience is often spread all over the world. The audience of entertainment television which

has worldwide distribution is comprised of different demographics spreading in gender, age, ethnicity, educational background, culture etc. Yet, this also means that the content cannot be tailored to a specific audience which can cause problems content wise, especially when dealing with content concerning knowledge.

In sitcoms, the storylines and characters have to be relatable which means that even if the story is set in a university environment and the main characters are scientists, people watching the specific series still have to be able to identify the problems, situations and characters depicted as familiar and related to their own lives. People who cannot follow conversations about e.g. black holes or string theory etc. have to be otherwise engaged in the scenes and storyline. In sitcoms this is done by integrating jokes and laughter into the scenes and dialogues in question. Yet they also have to be accurate and informative enough for audience members that are able to follow the conversation to be intrigued by it.

The fact that people would watch sitcoms for entertainment rather than information does not exclude them from picking up information though. I realized how much people get acquainted to certain things and topics they see on television after I started studying Biomedical Engineering and realized that whenever I tried to explain things we did and learned in university, people would relate what I said to various episodes of “CSI” (“CSI: Crime Scene Investigation” 2000). I did too. I used references to “CSI” but also the “The Big Bang Theory” or whichever television series was popular or had a recent episode featuring something I wanted to explain. Whether it was characters or procedures, I could find examples to explain the basics of applied sciences and the characters involved in it throughout various television series.

“The Big Bang Theory” is a series that is going to serve as example for a piece of entertainment television dealing with science, technology and scientists in this thesis. This sitcom is based on the private and professional lives of four scientists and the way they often struggle outside of their comfort zone which comprises computers, science fiction and physics. Because of the fact that this particular sitcom is commercially successful (it is currently in its seventh season and is distributed worldwide) it appears to be worthwhile to look at the connection that is made between the medium of the sitcom and science, technology and scientists in this specific case.

The focus of this thesis is going to be on how science is communicated within “The Big Bang Theory”, in order to observe the kinds of touching points between science, technology and “ordinary life” shown in this specific sitcom. The setting, as well as the characters, present an image of science which resembles ideas featured in similar series or movies, yet “The Big Bang Theory” promotes an approach to science that is different to others: it is relatable.

The educational background of the viewers does not seem to have a prominent influence on the series as it introduces science on different levels. The "scientific content" of various episodes provokes different reactions; viewers who are familiar with the terminology and featured procedures will find instances and scenes interesting or amusing that others who will not understand certain layers of the dialogue will be encouraged to laugh at for different reasons (e.g. the fact that they haven't understood what was happening can be regarded as amusing as well).

Laughter is not inherent solely to the sitcom, but humor of any kind is essential for the sitcom. The main basis of the communication is to make the recipient (the viewer) laugh in the end. Science communication aims at educating the recipient, raise awareness, state facts etc. Therefore the question arises: what happens if these two efforts are mixed together?

How is science communicated in a sitcom? How does the sitcom contribute to the communication of science? How is communication in a sitcom different to "other" science communication? The goal of this thesis is to investigate these questions under the premise that they examine the way science is integrated into a format that is not designated to communicate science or scientific knowledge.

As the sitcom, as a genre, provides its own set of rules and characteristics it makes sense to trace the embedding of science and technology along those lines. Therefore the main research question to follow in the process of this thesis reads as follows:

> *Using the rhetoric of a television genre: How is science communicated within the sitcom "The Big Bang Theory"?*

Accompanying, I have tried to formulate sub-questions to narrow down the elements in order to help building a coherent argument. The focus is on whatever even the most unexperienced viewer is able to witness during an episode of "The Big Bang Theory". They are based on three of the most essential elements of a sitcom in general: the story, the setting and the characters:

- What are the main possibilities providing a place to embed science and technology into the storyline?
- How are the main recurring settings in "The Big Bang Theory" determining the perception of scientists and their relationship with science in their private lives?
- Scientists have been depicted along specific stereotypes in movies already. In how far are these stereotypes still valid in the case of "The Big Bang Theory" and which new aspects come up in series that add to the perceptions of scientists?

Ideally, those questions will build a scaffold for the argument to be set up, leading to the conclusion in the very end.

More specifically this thesis is going to be set up as follows:

I will commence with theory, starting with an introduction of the state of art in science communication: What kinds of concepts are in use, why do scientists engage in the communication of science and where are we encountering science? I focus on the most "common" formats to encounter science such as newspapers/magazines and television. Furthermore, I will elaborate on my approach of choosing methods and selecting appropriate material as the foundational element of this thesis.

The adjoining chapter is dedicated to the sitcom. In order to be able to have a better understanding for the format as well as the necessities it demands, I want to look into its formal requirements in general as well as the main storyline of "The Big Bang Theory" and at what the genre of the sitcom has to offer for scientists as well as for lay people interested in science.

In the beginning of the second part, the analysis, I introduce the reader to one specific episode of "The Big Bang Theory", which should be considered as a representative for the way issues of science and technology are embedded into the series. Also it should elucidate how issues and aspects of scientific or technological nature can be played through in a 20 minute sitcom. The episode "The Cruciferous Vegetable Amplification" poses as an example episode which is supposed to outline the blending of science and technology into a plotline dealing with a personal issue of the main character.

The adjoining four chapters will address issues and aspects that can be found in this example episode as well as in a couple of specific other scenes from other episodes. In the beginning, the main issues arising out of the example episode will be discussed and further other issues such as the issue of place, the specifics of the main characters and the way science is organized and defined in its sub disciplines are going to be elaborated as well.

The last chapter features the conclusion I drew in the process of the writing this thesis.

## 2. State of the art and theoretical framing

Science and technology are part of everyday life in various forms and formats. They are a key essence for innovation and progression. They appear in the form of knowledge or physical objects. In one way or another they touch upon everyone's lives. They carry a lot of impact and power issues related to science and technology and are important topics of communication. Communication between scientists and the lay public are an essential part of education for the public, legitimation for the scientists and information for both sides. For scientists, who usually are at the top of communication efforts, their engagement in various communication efforts enables them to talk to the public as well as to make themselves, their work and their scientific field visible as well as to construct a shared identity for other research methods and interests (Bucchi 2008). The scientific side of the communication of science is highly concerned for this topic, while the lay public, which is on the receiving end of the communication chain, seems to have less interest.

We, the lay public, take a lot of things for granted (especially in regards to technology) and are mostly unaware of how exactly they work, what they are doing and what kinds of consequences they may have for society. While we appear to be oblivious to/possibly uninterested in a lot of issues concerning science and technology there is nevertheless a lot of information communicated to direct people's attention to certain developments and issues.
Whether it is the dissection of the advantages of a new iPhone or the threat of a snowstorm; information of this kind is somewhat essential for everybody's daily life and therefore communicated extensively throughout various information channels. The instalment of a new therapy to treat a genetic disease on the other hand, which only affects a small percentage of the population, is unlikely to receive the same kind of media attention. While it has often been argued that the public is not interested in science, it appears as though the public is indeed interested in science but rather in its consequences than the facts it provides (Radford 1997), as the impact of a specific information is easier to grasp and understand than plain facts.

But communication is an activity that is difficult to cultivate and conduct, especially when it involves science and technology. While abstract information seems universal, it nevertheless is always integrated into assumption that are bound to a specific culture and limited understanding (Wynne 1989, 19). No communication effort is ever truly objective, especially when embedded into more "popularized" accounts. The concept of popularization accounts for the notion that scientific knowledge is superior to popular, everyday-knowledge/common sense (Weingart 1998), it suggest that science has a monopoly on truth in society and that in order for the public to understand science better a mediator/translator like the media is required to transmit it to this purely passive public

(Weingart 1998). It has been shown though that the concept of popularization is not as easily applicable as argued before (Hilgartner 1990); communication of science underlies a variety of factors, whether they are of cultural, personal or professional nature.

## 2.1 Conceptualizing (science) communication

There are different models of communication which are often used in the context of science communication: the dominant view, the canonical account as well as the continuity model. All of which deal with the way science is communicated in regard to how knowledge changes in the process. The traditional conception of public communication of science describes science communication as a linear one-way process which serves as a process to transfer knowledge from one subject (e.g. scientists) to another (e.g. the public)(Bucchi 2008). In this conception the channel to convey scientific notions is the media, while the receiver of the communication is a passive public (Bucchi 2008).

Whenever scientific content is communicated, the same content has to be constructed in a way that fits its audience so that the receiver of the information is guaranteed to be able to access the information according to its educational status as well as background knowledge. The key to a successful communication therefore is to understand the audience as well as the way it has to be addressed:

### 2.1.1 Dominant view

The term "dominant view" describes the assumption that scientific knowledge is something that is perceived differently by different audiences. As Stephen Hilgartner phrases it:

> *"A two-stage model is assumed: first, scientists develop genuine scientific knowledge; subsequently, popularizers disseminate simplified account to the public. Moreover, the dominant view holds that any differences between genuine and popularized science must be caused by 'distortion' or 'degradation' of the original truths." (Hilgartner 1990)*

An underlying assumption of the dominant view is the "deficit model", a model that depicts the general public as unable to follow genuine scientific knowledge which is why it has to be popularized/ be told in terms "easier" to understand. The dominant view therefore defines that there is a difference between "genuine" and "popularized" knowledge, based on the idea that popularized knowledge used some kind of distortion of genuine knowledge.

### 2.1.2 Canonical account

In the canonical account the base assumption remains the same: scientific knowledge has become too specialized and complicated over time to be understood by the general public. Thus, there is a

need for a mediator who is able to manage the bridge between scientists and non-scientific audiences by "translating"/reformulating scientific discourse in more simple words (Bucchi 1998).
The mediation role within the communication of science is often given to the media, which also poses as the translator of the content they share(Weingart 1998). In order to do so, information eventually is miscommunicated or misinformation occurs, which only surfaces once the content is communicated already. This one way communication transfer, sent by the scientific community to the passive receiver that is the uninformed public, poses a certain dependency on the mediator. The canonical account therefore stresses the importance of efforts to keep those miscommunications low, in order to promote proper reception and understanding (Bucchi 1998).

### 2.1.3 Continuity model

The continuity model can be seen as a development of the aforementioned canonical account and claims that the boundaries between scientific knowledge and popular discourse are not easy to be drawn as there are various stages that knowledge has to pass in the process; ergo the passage of scientific notion through the various levels is not a simple translation but a change in notion (Bucchi 2008).

What the continuity model tries to represent is the idea that a scientific fact can be transformed into different degrees of knowledge, which do not interfere with the importance and "purity" of the content. For example even within the community of scientists there are "lay people" as well; not every scientist is a specialist in everything and the skills to translate a scientific fact into understandable and relatable entities can only add to the ability to cooperate among scientists from different fields. To make something graspable and understandable does not require the loss of its integrity.

### 2.1.4 Problems with the communication constructed

*"Public communication has been construed as a one-way street; projects concentrate on enlightening, educating and informing the public, rather than improving efficiency of knowledge flow from laboratories to users- or on sharpening audience's skill in interpreting scientific information."* (LaFollette 1997)

The previous quote by LaFollette illustrates that among the various problems that occur on the verge of science communication throughout the years there are two issues that seem especially crucial: the one-way communication and the lack of interpretation skills. Reflexive understanding is crucial especially when the content communicated is rather complex (Collins 1987) because otherwise we would end up believing anything as "science told us so". With reference to the communication of popularized communication efforts, Hilgartner also argues that it sometimes is enforced under a dominant view which sets aside genuine scientific knowledge as inaccessible for the public for

political/authoritarian decision making processes by scientists (Hilgartner 1990). It appears as though most of the traditional ideas of science communication are becoming more and more outdated which makes it interesting to try to find other approaches for the communication of science.

As the sitcom is not going to be treated as a source of "serious" scientific information it is able to aim its efforts to lightly feature spurs of information and at the same time possibly also spark an interest in the audience. While it is probably not able to deepen the interest/information, as a platform the sitcom itself can only encourage people to retrieve the details for themselves.

## 2.2 Scientists engaging in communicating science

In 1986 the Royal Society reflected on the question "*Would the world be a better, or even a different place if the public understood more of the scope and the limitations, the findings and the methods of science*?"(*Science, Technology & Human Values* 1986) and compiled a report which argued it would be indeed. The Royal Society is a fellowship of scientists that has been founded in 1660, which appoints them with the authority to raise as well as answer this question. In their 1986 report they also came to the conclusion that everybody needs to have an understanding about science and that improving this understanding would be beneficial for society (*Science, Technology & Human Values* 1986). From today's point of view, it seems daring to suggest that for the sake of society everyone must know about science. Yet, given that this report is almost thirty years of age, the general acceptance of science as well as the technological developments taking place at the time, retrospectively might make it a comprehensible conclusion.

As the Royal Society is constantly making an effort to promote science, they published another report twenty years later. This time they focused on the problematic of science communication performed by scientists and engineers. With the help of a questionnaire they tried to figure out whether or not science communication was important to the scientists/engineers and for what reason, as well as the reasons behind their participation. They used the outcome to give recommendations to scientists and engineers on how to increase their involvement in science communication. Some of the main findings included (taken from(The Royal Society 2006):

- Engaging with non-specialist public

  Most of the participants cited that the promotion of public understanding of science was their main reason to engage with non-specialist publics as well as communicating the value and relevance of science and lecturing, listening and understanding the public.

- Most important issues:

  The most important issue, as identified by the participants, was to ensure that the public would be sufficiently/better informed about science and technology, but there were also

claims that the recruitment of students and the contribution to ethical discussions were reasons to engage in science communication.

- Why not to engage in science communication:

  The lack of time was probably the main argument against engaging in science communication efforts, because the time the scientists would need to invest would be taken from their research. Also they felt that science communication is not well-regarded within the community and therefore refrain from it.

The Royal Society Report brought up an important issue as well: the importance of improving communication and engagement. Unfortunately, they were not able to find conclusions that would indicate a proposal for solution. Of course they aim to promote the public understanding of science and inform the public better and more sufficient, but what do they really want people to know? What is the aim of "making them understanding better"?

### 2.2.1 "Finding an approach for communication"

As already mentioned, in order to communicate science, science is often popularized. The scientific content remains, but the surroundings are changed; science and technology are taken out of the sterile context of a laboratory or a lecture hall and are taken "to the streets" so to say. The term "popularization" is used in this thesis as an effort to incorporate science into pop culture. In comparison to science communication, popularization is meant to go more unconventional ways. Interactive exhibitions, science fairs, open days/nights in laboratories, etc., the opportunities for creating settings to present science and technology are manifold and aimed to reach a very broad audience. The reasons for researchers to participate in such events are different and reach from promotion of one's own work to educating the public or to getting students into science. Sometimes those efforts are successful, sometime they fail but the important thing is to get the message out.

The main reasons for scientists to engage in popularization are very similar to the ones for science communication carried together in The Royal Society Report and can be summarized as a feeling of duty, an urge to spread knowledge about science in general, a need to familiarize the public with a specific field of research as well as a wish for appreciation and better funding (Kreimer, Levin, and Jensen 2011; Jensen 2011).

Science and technology are driving forces in the improvement of everyday life, yet the average citizen often has little to do with them apart from operating their smartphones or taking medication. People sometimes just aren't that interested in technology and innovation until it is being sold to them in one way or another. To a certain degree it is therefore possible to think of popularization of science as some kind of marketing tool. But instead of selling a fully developed and commercialised

object, ideas, inventions and prototypes are sold in order to spark an interest; having people's interest might be a key to their recognition, funds, support etc.

Also the fact that knowledge is popularized and part of a public discussion makes it in turn interesting for the scientific community as well; even though the perceptions of the scientific community are supposed to be influenced by the public's reaction to a topic or technology (Weingart 2001) it turns out that the approval of the public helps legitimizing a specific topic. For example it has been shown that certain analysis methods which have been featured in television drama series are more approved by the public than others although they might have been controversial at first (Ley, Jankowski, and Brewer 2012).

### 2.2.2 Who engages?

While reading through literature dealing with the popularization of science it appears if there is to be a specific profile of people involved in science communication. Especially in situations in which there is a demand for scientists acting as experts, for example for radio/television interviews, newspapers or conferences, senior scientists with a higher than average academic record were likely to be engaged (Jensen 2011; The Royal Society 2006). Certainly due to the fact that senior scientists hold the authority to speak in public as representatives of their field and the institutions that dispatched them and they maintain a lot bigger networks inside and outside the scientific community (Jensen 2011).

Junior scientists on the other hand are more likely to be engaged in the actual process of doing research especially research concerning more "local" questions focused on very precise problems (Jensen 2011); in comparison to their senior colleagues who, according to Jensen, are more dedicated to "general" questions aiming at more global theories and concepts. The prestige of senior scientists and their supposed expertise might be the reason that gives them the opportunity to be on radio or television whereas their junior colleagues are engaged in other kinds of popularizations, such as giving talks at schools or open door events in scientific institutions (Kreimer, Levin, and Jensen 2011).

In a way it makes sense to have senior researchers engaging in the more public debates and discussions as they do hold authority, yet it seems as if constantly exposing senior scientists to a broad public enforces a specific stereotype of scientists which might repel a specific kind of audience (young people, less educated people) to take an interest.

On the other hand journalists, producers or the like might have more practical thoughts about hiring a scientist: one specific scientist might be especially likeable, another might fit the image the journalist would like to promote and another might be a more skilled communicator (LaFollette

1990). So the question of who engages essentially is one that is dependent on what exactly the people behind the curtain want to communicate as a whole.

### 2.2.3 Science consultants

For movies/television/"The Big Bang Theory" there are often scientists working in the background of the production in order to make sure the science portrayed/communicated is accurate and/or feasible. Rather than communicating science, they consult the production on science related issues. Those science consultants nevertheless hold an important position in terms of communicating science to a broad and diverse public.

Science consultants have the unique opportunity to not just promote their own work, while collaborating with movie-makers, but at the same time they are able to see ideas come to life that might never see the light of day had they been brought to life in the environment of the laboratory. You might not be able to actually do "proper science" and develop fully functioning technologies when consulting screen writers or movie director, but the fact that you get to be creative and imagine things ahead of the current standards and technologies occasionally is an incentive for scientists to engage in this kind of entanglements (Kirby 2003a; Kirby 2003b). Also the money they earn in engagements like that can be very useful for their actual research. Sometimes their commitment is also based on the fact that there has been a lot of controversy around their specific field of scientific interest and the involvement in a movie may be a sophisticated way of putting in in a different light and ease the tensions around it (Kirby 2003b).

Because the series "The Big Bang Theory" is revolving around a group of scientists, especially physicists, it is vital for the producers to have someone checking over the facts in conversations to help them creating a feasible environment for the characters to be set in. David Saltzberg, who currently is a Professor for Physics and Astronomy at the University of California, Los Angeles, is the science consultant for "The Big Bang Theory" and while his main task is to help the writers to create "accurate" dialogues ("to get the science right") another one of his duties is to create the whiteboards which are scattered around the main settings of the sitcom (and will be discussed in Chapter 6). Asked in an interview about his involvement in the sitcom, Saltzberg stated that he is involved in consulting the show for public outreach as well as fun ("The Science of the Big Bang Theory » Scienceline" 2013). As he points out in the interview, there is a specific interaction with the audience of the sitcom that he sees as motivation to stay engaged as the show appears to spark people's interest in science, which he thinks is an accomplishment ("The Science of the Big Bang Theory » Scienceline" 2013).

The science consultant is an important link as he provides scientific insight and is able to help transforming it into content for a movie or television series. His position resembles that of the media in the canonical model (Bucchi 1998); only in this case a scientist has the sufficient "legitimacy" to communicate in comparison to the media within this model, which often lacks this formal legitimation.

## 2.3 Encountering science (communication)

There have been claims that in order to improve science communication the following points must be taken into account: any form of communication is better than none, information has to be absorbed in its entirety and isolated, quality can only be reached by accuracy, scientists must be involved (otherwise accuracy cannot be guaranteed) and over all the non-scientists must be persuaded by the product communicated (LaFollette 1997). What all those claims embody is that science communication is a means to promote an idea. Yet sometimes to communicate science is about spreading valuable information just as much as it is to entertain a prime time audience. The question is only in which way science and technology are being presented.

### 2.3.1 "Serious journalism"

If you want to reach out to a broader public you have to be able to advance into the sight of people that have not been looking for you. But as soon as, for example media come into play, other rules of communication are applied. The way a topic is covered in a newspaper varies from the way the very same topic is presented in the evening news. And even if we stay in the same medium, for example television, there are still differences in how an issue is presented depending on the format or the segment they are shown in (e.g. news, information magazine, science program, discussions, etc.).

Newspaper editors have other reasons to include science in their spreads, often they are put in place because they are either funny, amusing, intriguing, disgusting or even frightening (Radford 1997). As mentioned above they must know their audiences, as well as meet their wishes, because on the one hand they have to obey to political realities or basic economics of publishing (LaFollette 1990), and on the other hand they are almost completely dependent on people buying their papers and magazines. While papers are made to be read (Radford 1997), they nevertheless provide an important space for promotion of science and to familiarize the public with scientific as well as technological content.

Within a single newspaper there is much less space/reason to present a specific topic in different ways, simply because there are spatial restrictions(Dunwoody 2008). You might give a breakthrough in genetics a big spread the one day to present it and if it comes up again in a few weeks' time you only touch upon it in a side note, but there is no variation in your target audience so there is no need

for you to cover it from as many angles (as possible). As an editor you know your readership well and you go through the golden middle to present content understandable for them.

But maybe the most shaping element of science journalism in newspapers is the fact that it is bound to the procedures of a newspaper. Not accidentally the coverage of science topics resembles that of other areas, they all have to pass through the same production infrastructure (Dunwoody 2008). While a journalist might have sophisticated knowledge of the topic he covers in a small article, he simply might not have the time and space available to write and publish a more in depth article.

Whether it is television or newspapers, the people that are communicating science in these settings are journalists and they may be involved in lay-expert communication in different ways. It also has to be taken into account that the journalist is the expert (and powerful entity) in this arena which means he shapes the image of the scientists and their findings in a way that fits his own assumptions and imaginations (LaFollette 1990).

Rebecca Slayton, for example, talks about two traditions: the pedagogical tradition of science journalism and the 'interactive' tradition (Slayton 2007). The pedagogical tradition dealing with the improvement of public education with a one-way 'transmission' model, focused on the differences between communicative norms and science and the media in contrast to the interactive tradition which challenges the assumption of differences and argues for a more complex model of lay-expert communication (Slayton 2007). The way science is covered in the media is very much bound to the ways the specific medium works as well as its settings and boundaries. The only thing that stays throughout all the different media is the fact that a more or less lay audience will consume the information in the end. Slayton points out the crucial part of the communication process in the end when she says that:

> *"… lay persons do not passively receive scientists' messages, but actively interpret them in relation to local contexts, rejecting what they do not find useful or trustworthy."* (Slayton 2007)

This sentence displays the problem with the classic way of communication/the deficit model in a nice way: while the communication might only go one way and the message might be very clear, the audience is still able to use the content in any way they want (and it might not be the way the communicator might have intended).

### 2.3.2 "Entertainment television"

Science has been part of the television industry since its very beginning of it and the way science was presented has grown and changed over the years. As the number of households with television grew, the audiences grew and as times changed the demands for television programs changed as well;

starting with classic educational television to the realization that science is not black magic and might potentially be funny to watch (LaFollette 2013).

Yet in terms of science communication the embedding of scientific content into entertainment television was not particularly appreciated:

"*Communication scientists almost looked down upon entertainment. This may have been due to a normative preference for information (facts), as opposed to entertainment (in sense of fiction), which was regarded as a threat rather than an enrichment of public communication. Moreover, entertainment is often considered too commonplace for research."* (Görke and Ruhrmann 2003)

Entertainment, in this context entertainment television as well as cinema, is mainly fictional and involves a lot of jokes, therefore the claim that it is not essentially an enrichment of public communication is probably fair enough but at the same time, humour does not automatically devalue serious content. The fact that the main point of focus is not on the scientific content but a specific kind of storyline does not mean that the portrayed science or technology is irrelevant or inaccurate. Quite the opposite is often the case.

As David Kirby argues, movie producers often hire scientists to consult them in order to bring reality and sufficient credibility to a movie (Kirby 2003b). Entertainment and education are not opposing entities. Science consultants for example act as an interface between the two.

What Kirby also points out very nicely is that cinematic images and narratives may have an impact on the public's conception of science as they are able to provoke reactions whether they are enthusiasm or fear (Kirby 2011). In order to attract attention it is important to load information with an emotion (Schnabel 2003) and the emotional stories are just more bluntly shown in a cinematic environment than to be read in a newspaper.

Even though different formats/programs on television are a legitimate source of information, the general idea of receiving information from television shows is that they won't provide the viewer with legitimate knowledge but only popularized versions of it. Television, so it seems, is not a medium approaching contentious issues. But the thing with being a medium is that it provides different formats and a news channel is providing the public with accurate real time information. Nobody doubts that news are "real" and "right" when they are presented in a news program (real and right in the frame of the specific news channel), but when it comes to matters of science and/or technology, knowledge or information seem less legitimate when it comes from a non-news related or entertainment program.

But as Anthony Dudo et al. show in their paper on science on television in the 21st century television and especially prime time drama series bring a certain amount of information about science and

technology into the audiences' living rooms. Quoting a report from the National Science Board they claim that:

> *" […]although it is safe to conclude that the internet is affecting what Americans know about science and technology, it is also true that what most of them know about the latest developments in these subjects comes primarily from watching television*."(Dudo et al. 2011)

The advantage of television especially entertainment series is that as they are seen as fiction; the possibilities of involving science, technology and innovation make people wonder. Ideas are introduced to a broad audience. While in this format the viewer might not be essentially educated about a certain issue, they might learn other things concerning those topics which are interesting as well.

For example watching a crime series where the viewer is constantly faced with techniques of how to extract DNA from more or less random samples might give them a more applied idea about where DNA can be found, as well as the knowledge that human DNA is specific to each individual (Ley, Jankowski, and Brewer 2012) on the one hand, as well as reinforce the feeling that you can always rely on the certainty of science (as in the end the villain will be caught due to a hair follicle he left at the crime scene)(LaFollette 2013).

If people are aware that the science represented is a blend of authenticity and fantasy (LaFollette 2013), they might discover curious things and might be inspired to learn a little more. Maybe they don't care, but they still spend some time listening to something they had not before known.

## 2.4 The audience engages

While most of the science communication efforts are top down and one directional from the scientists engaging to the audience receiving, there has been a shift in the way how the audience processes information nowadays especially when the scientific content is part of popular culture as it is in "The Big Bang Theory". Even though the audience might not be able to reply directly to the people involved in the sitcom or any kind of science communication efforts, they are nonetheless able to voice their concern as well as their approval, for example by sharing it on blogs, in the comment sections of online articles or in forums etc… There are numerous viewers praising "The Big Bang Theory" for their accuracy and portrayal of scientists ("EVERYBODY'S A CRITIC: A Real Penny, Married to a Real Sheldon, Discusses 'The Big Bang Theory'" 2013; "Good Question: Is 'The Big Bang Theory' Science Real? - CBS Minnesota" 2013) just as there are equally much people condemning them for the stereotypes employed and wrong reflections ("Why Does The Big Bang Theory Hate Nerds? | CliqueClack" 2013; "Stereotyping the Stereotypes on 'Big Bang Theory' | Thus Spake Zuska" 2013; "The Problem With The Big Bang Theory..." 2013). The people engaging in this kind of communication are lay people as well as scientists ("Jennifer Ouellette: The Big Bang Theory" 2013)

voicing their “honest opinion” as opposed to trying to “scientifically” dissect their interest, which is to say that “The Big Bang Theory” is treated as a television program that people engage with in their spare time and treat it as something personal. While those people do not communicate science, they express their personal opinion about the sitcom online, visible for anyone interested.

The engagement of the audience is not only valuable in terms of their own involvement with science and technology, it is also valuable for show runners and the distributing network because it can help keeping viewers as members of a core audience.

## 2.5 Stereotypes

The white male, white lab coat wearing scientist has been used as the go-to image of the depiction of scientists for decades. It started in the late 50ies when "proper" scientists (LaFollette 2013) appeared on television meaning they were there to demonstrate experiments and wore lab coats for safety reasons. The image stuck and the white lab coat now appears to be the distinctive mark for the recognition and identification of scientists in pictures as well as on television. It is a perception which is reinforced by the recognition value that the mad scientist with the crazy hair, big glasses and white coat standing in front of fuming dishes containing colorful boiling liquids has in the eyes of the audience. The modern scientists on television may no longer look like the "Nutty Professor" in general, there are a lot more female characters shown and the boiling liquids have been replaced by computers and digital analysis equipment, yet the quintessence of the image of a scientist, the coat and the sterile laboratory in the background remain. To a certain degree this might be an accurate depiction of scientists working in a laboratory, yet it does not reflect the entirety of the scientific community. There are scientists that work in offices rather than laboratories and not every laboratory looks as sterile as the analysts within the laboratories on CSI (“CSI: Crime Scene Investigation” 2000).

As people are unlikely to meet "real" scientists in their daily lives they may, to a certain degree, buy into the image they are sold. Things that people can recognize don't need to be explained and therefore save time in television but using visual imagery reinforces the perception and therefore creates a visual stereotype.

Apart from the visual image of the scientist there is also a characteristic image of scientist’s behavior featured on television. They are somewhat "different", highly intelligent and either problem solvers or problem makers (Frizzoni 2004). In movies they are either presented to be heroes (because of their ability to solve problems) or to be mad scientists (because they would be the ones causing problems), which also has an effect on how the perception of scientists on television is formed. In general, the mad scientist serves as a reflection of the fear of the consequences science and

technology may cause (Frizzoni 2004), which is a fear that is inherent to the audience and therefore makes for an emotional story (which is more "remember able/remarkable" for the audience).

Weingart divides the scientist that face these kinds of situations in two different types: the benevolent scientist, who is naive when it comes to powerful interests and means well, and the ambivalent scientist, who is easily manipulated, idealistic, progressively corrupted and willing to sacrifice ethics for gaining new knowledge (Weingart, Muhl, and Pansegrau 2003). What Weingart points out is that scientists are often shown to be vulnerable characters, yet they have their own approaches and are not easily pushed around. On the other hand the idea that they are objects of mockery, are awkward and possess intellect rather than intelligence (Terzian and Grunzke 2007) is an issue in the portrayal of scientists as well. It is difficult to paint a coherent picture of how scientists are portrayed in movies and on television as these portrays certainly are influenced by the times and culture they were created in (LaFollette 2013).

The amount of mad in contrast to genius/ good and bad in general is to a degree dependent on the genre the viewer watches. In horror stories the probability to find a "good" scientist is as small as finding a really dangerous one in a comedy. Still there are other sets of characteristics that both of them often have in common: they are shown to be hardworking, often absentminded and/or a bit confused, they may be outsiders as well as potentially antisocial (Flicker 2004). They also wouldn't be very attractive, wearing glasses, having crazy hair and unfashionable clothing; but they also wouldn't care as they have more important things on their mind (Flicker 2004).

The line between mad and genius is sometimes difficult to negotiate. The character of Sheldon, for example, may not look like a trouble maker, yet has a tendency of creating drama. The traits that geniuses hold is that they have an excessive perception as well as vast imagination (Keller 2004) which can be perceived as intimidating by others. Paired with scientific knowledge they can become a threat like Sheldon when he creates drama, but it also works as a motivation to create and achieve something. Either way those "borderline" characters can create storylines in both directions and therefore are interesting to use.

Interestingly being a mad scientist is something that stereotypically is inherently male, while female scientists are mostly portrayed to be "good" scientists. The image of the female scientists is based rather on the dichotomy of being smart and intelligent or good looking. In a lot of portrayals of female scientists there is the perception that they can either be a scientist or a woman, meaning that if they are accomplished scientists they would not be attractive, while the good looking and charming females often would not be described as accomplished scientists (Erlemann 2004). The portrayed characters in movies and books range from the assistant, whose role it is to support the male lead, to

the lonely heroine, who puts science before everything else, especially men and their looks (Flicker 2004). In the light of these general perceptions in movies it is interesting to see how the female scientist characters are portrayed in "The Big Bang Theory". While it had taken a couple of seasons to incorporate them, the show runners managed to include two characters that appear to be equal to the male scientist characters.

# 3. Material and Methods

## 3.1 Methods

In order to find fitting methods for the analysis it seems crucial to point out the main source of material first. Most of the material is content of "The Cruciferous Vegetable Amplification" (Season 2 Episode 4), one specific episode of "The Big Bang Theory". It consists of dialogue lines, transcripts of laughter and pauses as well as screenshots and notes on specific sequences and within the episode. In order to stress certain arguments, I have included material from other episodes as well; those will be specifically marked in the analysis part.

As the foundation of this thesis is an episode of "The Big Bang Theory", it seemed only fitting to start observing the happenings in the episode by watching and re-watching as well as transcribing it. One of the advantages of observation as opposed to approaches based on text is that it can build a foundation of impressions which can provide a ground for interpretation and analytic use as well as it can help seeing things that are invisible when the focus is set on conversation (Becker and Geer 1957). Approaching the analysis by starting to observe was important to get an idea of how a sitcom is structured as well as to gain a grasp for the punctuation, the context and content and of the characters. It felt important to have an impression of the whole episode before any further steps were taken.

The first approach to work through the material was ethnography. As John Law puts it "[*Ethnography] looks behind the official accounts of method (which are often clean and reassuring) to try to understand the often ragged ways in which knowledge is produced in research."*(Law 2004).He refers to the fact that ethnography is used in researching knowledge practices and point out how ethnographers of science use a constructivist approach in order to create scientific knowledge from scientific practice. As a means of observation, ethnography "partakes" in practices and modes of discourse and it embodies presence as a key to research (Pollner and Emerson 2001). The problem with ethnography in the case of this thesis was that the sitcom is not a real place. While it is possible to observe the characters, their actions are not determined by them; they are a product of someone else's imagination. As an observer it is not possible to experience the presumptions made of science and technology by the people implementing them into a storyline. It is also impossible to directly observe the imaginations produced by viewers of the show.

As ethnography seemed not sufficiently applicable in this case the next step was to try if ethnomethodology could provide other ideas, approaches or insight to be used and worked into notes and transcripts. Ethnomethodologists would claim that they are a step ahead of ethnographers as their approach is apparently more comprehensive. Their focus is the orderliness of social life as it

is experienced, constructed and used from contexts and activities (Pollner and Emerson 2001). The indifference of ethnomethodology is that it is not supposed to take up 'gratuitous scientific instruments' such as social science models or methods or schemes etc. and treats the world it studies as a source of theoretical insight (Lynch 1999). This idea seemed appropriate enough therefore the episode "The Cruciferous Vegetable Amplification" was re-watched, transcribed and previously conducted notes were refined. Speaking pauses and raised voices, facial expressions and physical movement were added into the transcript. In order not to miss any detail, the settings were described and documented. These notes provided the ground for text analysis on the one hand and documented the visual evidence for different claims on the other hand as well.

### 3.1.1 Grounded Theory

After this step was completed, Grounded Theory was used in order to find fitting codes for the analysis. In Grounded Theory, the coding process consists of categorizing segments of data by giving them short names that summarize as well as describe each part of the data (Charmaz 2006). There are two phases of coding : Initial coding, which uses fragments of data, and focused coding , which includes the testing of codes against data (Charmaz 2006).

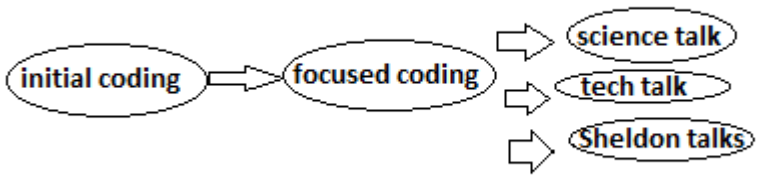


**Figure 1 Coding process: Initial coding, focused coding and subsequently the grouping of the codes to three specific sub groups used in the analysis of "The Cruciferous Vegetable Amplification"**

Figure 1 illustrates the procedure of coding the episode "The Cruciferous Vegetable Amplification" of the sitcom "The Big Bang Theory". The initial coding is the first step and is done either by going through the data word-by-word, line-by-line or incident-by-incident and ultimately breaking the data apart into smaller pieces that would compose a certain code in the end, which would hopefully be fitting and relevant (Charmaz 2006). In the first read - through of the transcript everything that was related to science and technology was marked; technical or scientific vocabulary, unusual expressions etc. After those words and expressions were identified, they were clustered into three groups which should reflect their origin (see Table 1). The first group was "science talk" which includes everything identified with being related to science opposed to what was related to technology, which would be grouped under "tech talk". Most of the expressions found where the lines of the main character Sheldon and therefore they were called "Sheldon talks", which could be of interest when looking into the character of Sheldon.

| Science Talk | Tech Talk | Sheldon talks (science) |
|---|---|---|
| Working on that research | Longevity | My body is too fragile to endure the vicissitudes of the world |
| Hereditary | KBB- Killed by Badger | My physical body is safely enclosed in a secure undisclosed location |
| Propensity for disease | Uncle Carl factor | Remove the spectre of fiery vehicular death |
| Fight or flight instinct | Singularity | Halt. Authorized personnel only |
| Coded genetically | Transfer consciousness | How I'm statistically most likely to die? |
| Flawed DNA | Machines | Until I can transfer my intellect to a more durable container, my body will remain safely ensconced in my bed |
| Somebody working on that | Freakish self-ware robot | Discrimination against the otherwise located |
| Cruciferous vegetable night | Unified field theory | Obligations and duties of the parties in the event one of them becomes a robot |
| Brussels sprouts | Cold fusion | |
| Fuse my consciousness | The dogapus | |
| Pain radiating | Cybernetics | |
| Lower right abdomen | Cybernetics is robot stuff | |
| Nauseated | | Turn yourself into some sort of robot |
| Feverish | Exercise regimen | |
| Cholera | Strengthen cardiovascular system | |
| Malaria | If we talk it will create the illusion of time going faster | |
| Hirschsrpung's Disease | High powered binoculars | |
| Scoliosis test | Heart rate monitor | |
| Botulism | Pedometer | |
| 30 foot tape worm | Telematics | |
| Accidental ingestion of chrysanthemum blossoms | Reading up on biomechanics | |
| Less than vigilant proprietor | Mobile virtual presence device | |
| Appendix | Transfer into consciousness | |
| Appendix, a vestigial organ | When did he put a ramp in | |
| Appendicitis | I disassemble into four pieces | |
| Sphincter | Enhances capabilities | |
| Muscle | Photoshop | |
| Human body | Digital watch | |
| 1911 Solvay Conference | Override switch | |
| Theory of radiation and quanta | | A doorknob has you stymied |
| Anachronisms | 1977 Apple Two | |
| Madame Curie | File system limitations | |
| Professor Hoskins | Apple DOS 3.3 | |

| | |
|---|---|
| Dr. Nakamora | Sing to a computer monitor |
| Swedes disproved your theory | |
| Member of the weasel family | |

Table 1 Initial Coding for science and technology terms and expressions

Table 1 was then used as a basis for further coding. It provided an overview of indicators for the presence of science and technology in the dialogue. While it was sometimes visually apparent that the lead characters were scientists, it seemed interesting to learn if there were indicators of their occupation throughout the episode apart from the visual evidence. This list might not be definite proof for this, yet it still illustrates that there is an increase in specific vocabulary which is unusually found other sitcoms.

### 3.1.2 Focused Coding

Following the initial coding, the focused coding aimed at putting the fragments back together. It uses the most significant and/ or frequent codes in order to examine data and to make analytic sense of it (Charmaz 2006). In the case of this thesis, this meant to commence with the "science talk" block and rearrange, group and sort the words until they made up four more specific clusters: Hereditable, Disease, Science/Physics and Science/Biology. As the storyline of this episode deals with elongating one's life, it makes sense that the content and vocabulary relate to diseases and biology. Yet the specific vocabulary itself shows that the characters have extensive knowledge of science otherwise they wouldn't use those words. "Hereditable" is a collection of terms revolving around the issue of DNA coding and inheritance. "Disease" counts all the diseases that are mentioned in the episode and the "science/" terms align words and expressions used which appear to belong to a certain "scientific category". The results of this step of grouping can be seen in Figure 2.

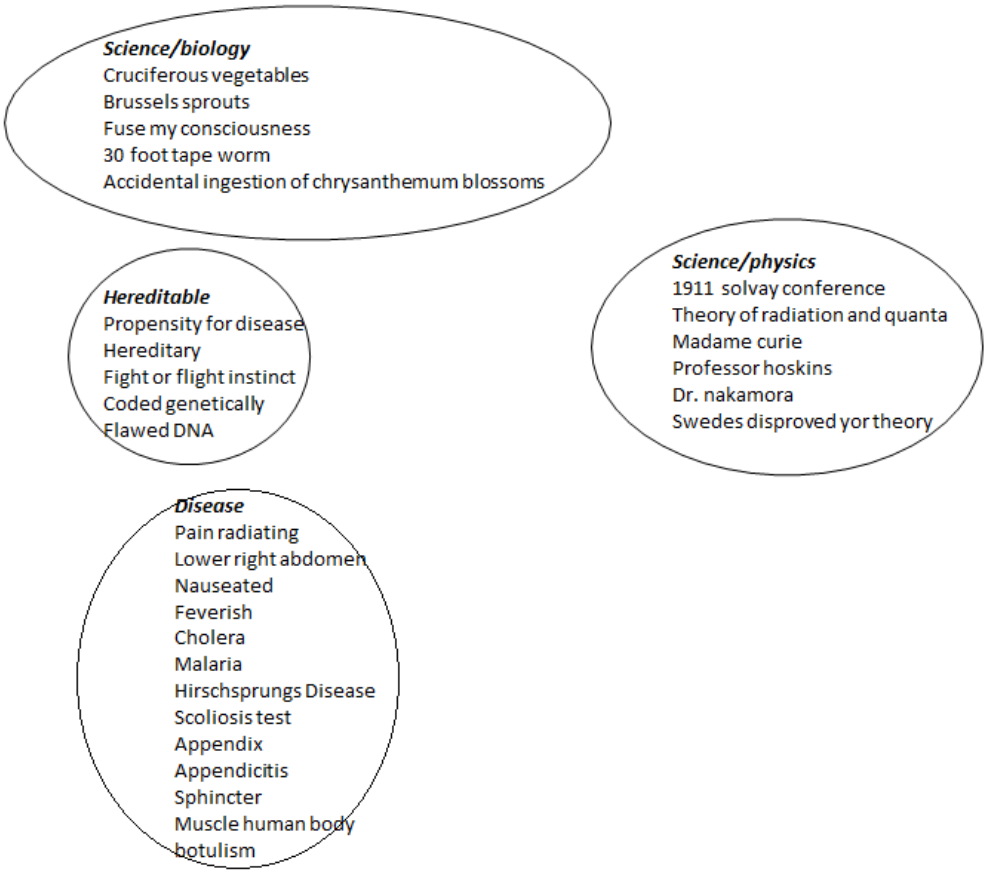


**Figure 2 Science Talk: Clusters with words grouped around issues related to "science" in general**

The "tech talk" category began as a clustering of all the words that appeared to have a technical connotation to them. On closer examination it became obvious that there were two kinds of terms in the initial cluster: either they were "proper" or "made up". The "made up" terms are word creations which sound rather technical but are not real. The "proper" terms have then been further categorised and formed 4 sub-groups: machines, technology, computer and mobile virtual presence device. Once again it appears as though the vocabulary reflects the content of the episode spanning from the wish of "singularity" to the actual instalment of "the mobile virtual presence device" in the plot of the episode. The 4 sub-groups can be seen in Figure 3.

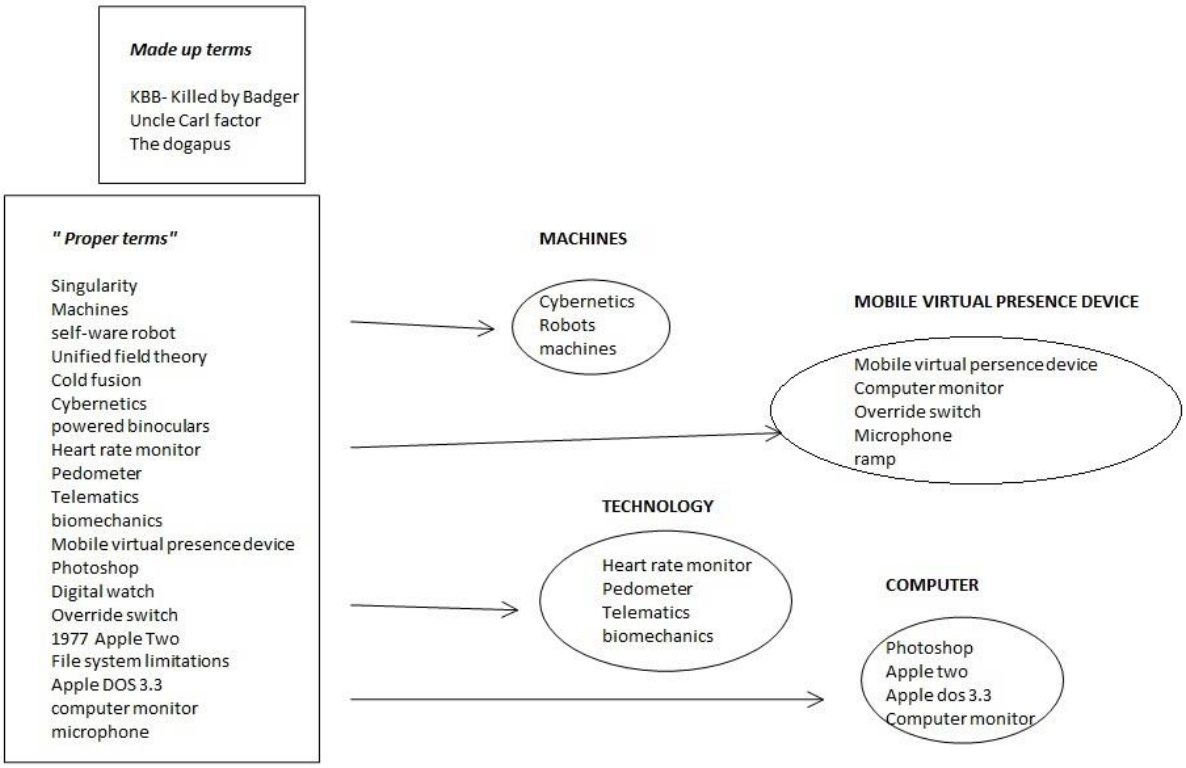


**Figure 3 A sketch of how the groupings came together in the issue of technological terms used in the episode „Cruciferous Vegetable Amplification".**

The next step was to connect these codes. The bubbles were taken together as organized codes and the episode was re-watched under the premise to put the bubbles and the storyline together in order to see how the content of the dialogue was going together with the pace and humour of the series. It became obvious that the content and story are interwoven in a way that would explain every term (not literary, but in a way that the use of the term becomes apparent). There was the interesting paradox that the one person naming and describing all kinds of diseases didn't realise that he wasn't sick. There also were a lot of references to technology etc.; those aspects would make up the main aspects which are going to be discussed in Chapter 6.

### 3.1.3 Video Analysis

As the main sources of information in this thesis are episodes of "The Big Bang Theory" it seems essential to address video analysis in this context as well. The text analysis can only be a complement to the analysis of what can be seen, as the moving image is the essence of a television series. A video can be seen as an indispensable medium, allowing to collect data and to preserve relevant features in a naturalistic perspective (Mondada 2006). The rules and regulations for what technically has to be applied in the making of a sitcom episode aims at one specific thing: to entertain the audience. If we look past the jokes, "The Big Bang Theory" reflects imaginations of science, technology and scientists that to a certain degree resemble those of the audience.

The video analysis provides visual evidence. While the dialogue advances, the plot situates the relationship between the characters, their physical appearance, glances and movements disclose even more about the single characters as well as about the situations they find themselves in. These instances are what video studies try to capture: people acting in an area of action in visual co-presence (Knoblauch, Schnettler, and Raab 2012).

There are two approaches for video analysis/research: the inductive and the deductive approach (Derry et al. 2010). Both are based on the kind of question supporting them. The inductive approach uses a broad question that investigates a minimally edited video corpus without a strong orienting theory while the deductive approach focuses on a strong theory as well as a clear research question which then help to identify or create a suitable video corpus (Derry et al. 2010). In the case of this thesis the starting point was a broad question and a closed amount of video (one specific episode), but as the thesis advanced more specific questions and videos (episodes) tailored to the questions were included.

As there would have been too much content if other full episodes would be used, it was decided to only use relevant scenes from other episodes that could add to the building argument or stressed one of the aspects already evaluated within “The Cruciferous Vegetable Amplification”.

## 3.2 Material

In terms of material the focus was on what was easily available and seemed accurate and as close to the series as possible (in case of the interviews):

### 3.2.1 The Big Bang Theory Season 1-4

“The Big Bang Theory” is a sitcom which has been running since 2007. Until now, seven seasons have been aired containing 23 episodes each. Most of the episodes referred to in this thesis are taken from the first four seasons, mainly for practical reasons: I was already familiar with most of them, as they were shown on daytime television almost every day and easily available on DVD. When this thesis was started, the fifth season had just become available on DVD and the sixth season had just premiered on American TV, meaning it had not been released on Austrian/German television networks until a few months afterwards.

It seemed important to have as many episodes as possible available at all times to be able to look at specific scenes when necessary. Another perk of watching them via DVD in comparison to watching them online was (apart from the quality) the fact that one can rewind, switch the language and subtitle of every episode at any time.

All episodes were watched and transcribed in English. Even though “The Big Bang Theory” is dubbed when it is shown on Austrian/German television, the decision was made to stick to the original language. There is no severe problem with the synchronisation in general, yet it is “more truthful” to look at the scenes the “exact” way there were intended, or at least how they were initially aired. As the jokes are often based on specific vocabulary, the initial joke would differ when translated especially in regard to wordplays and references. The German translation often does not contain the ”accurate” translation but one that makes “more” sense in German.

There is one episode discussed in detail which is taken from the beginning of the fourth season (Episode 2 “The cruciferous vegetable amplification”) which has been chosen to be able to have a full exemplary storyline laid out in order to illustrate the course of this specific sitcom and give an indication of how science and technology are embedded into the story. This very episode was selected because it was one that specifically focused on technology and its consequences. In sitcoms, it is usually common to have two different plots linked into one episode, with one being the “main” storyline engaging one main character and another smaller storyline engaging another character (Mills 2009; Marshall and Werndly 2002). Yet, in this specific episode there is only one storyline, focusing all the attention towards one character and the development of his idea to prolong his life.

### 3.2.2 Interviews

In order to get an idea of the motives behind the series a range of interviews were collected online which were done with the producers as well as the science consultant of the show. The interviews quoted have all been published online and most of them provide transcripts. The form of a transcribed interview is supposed to reduce the possibility of trapping into the presumptions of the journalists to only quote them for an article and this way there would be “proof” of what they were saying. Still the transcribed interviews are not as accurate as self-conducted interviews. The exact context in which the interview has been carried out is unknown and it remains unclear whether or not the interview has been reworked. Without this kind of context it remains difficult to interpret some of the articulated thoughts.

The interviews used here were mostly those done with one of the producers and those featuring the science consultant of the series. It felt like those two would provide insight into the two different sides that the series offers, the entertainment industry and science (regardless of the fact that they were only “second hand” interview sources).

# 4. The sitcom as a means for communication

In order to give an insight on what the main features and aims of the genre of the sitcom, are I will give a brief introduction into the genre in general as well as into the specific features of "The Big Bang Theory". The following chapter will also touch upon the role of the audience and the possibilities the genre of the sitcom provides in terms of the communication of science.

## 4.1 What is a sitcom?

The word sitcom originates from situational comedy, which means that the comedic elements derive from situations. The sitcom is a subgenre of the comedy, which also includes other formats like stand-up, live comedy shows or sketch format shows (Marshall and Werndly 2002). Along these lines, it is generally argued that a sitcom can be defined by its comic impetus, as all of its textual elements are based upon comic aspects (Mills 2009). But as Mills also points out, there is a distinctive line between comedy and telling jokes; comedy would most importantly incorporate "[…]factors such as narrative, character and representation all help define the genre too."(Mills 2009); telling jokes does not require the kind of elaborate narrative comedy does.

There is not "the" one specific definition to what exactly constitutes a sitcom. In order to put a television program into the genre of the sitcom, it is more about ruling out other genres (Mills 2009). Nevertheless there are a few indications which are included in most sitcoms:

- An approximate length of 30 minutes
- Recorded in front of a live audience
- The use of laugh tracks
- Recurring characters and places
- Happy ending

The most important elements in a sitcom are the narrative as well as the characters, both of which are embedded in the storyline; they are subject to more specific rules. As Mills further elaborates the storylines have to be easy to understand, in order to ensure that the audience can follow the happenings even if they are not familiar with the series and/or have missed an episode prior to the one they are currently watching; the episodes have to be entertaining and it is important that the stories are "closed" within an episode, e.g. at the start of the episode a problem occurs which has to be solved by the end of the episode (Mills 2009). Even though most sitcoms are developed according to this scheme, those are exceptions to the rule which nevertheless can be regarded as sitcoms as well.

All these criteria certainly apply to “The Big Bang Theory”. An average episode is about 21 minutes long, it features a small recurring cast and the storylines of the episodes usually lead to a happy ending. When watching an episode on television the laugh track is clearly audible and it is recorded in front of a live audience. Occurring problems are resolved within one episode, only a few bigger storylines run throughout a whole season. Formally “The Big Bang Theory” fulfils all those requirements and can also be practically perceived as a sitcom throughout.

## 4.2 The Big Bang Theory

“The Big Bang Theory” is an American television show which first aired in September 2007 in the United States. Since March 2010 it is also shown on ORF1, one of the main channels of the Austrian National Television Network. Until now, it has been distributed to over 50 countries worldwide.

As already mentioned, the main characters are scientists, except for one female character who is introduced as the love interest of one of the main characters (Leonard). The characters are Leonard Hofstader, an experimental physicists, Sheldon Cooper, a theoretical physicists, Rajesh (Raj) Koothrappali, an astrophysicist, Howard Wolowitz, an aerospace engineer and Penny, a waitress who lives across the hall from Leonard and Sheldon. The stories told about them, revolve around their professional as well as their personal lives. The creative challenge in this setting is to find humour in even the most banal situations (for example being stuck on a problem at work or in an argument between roommates about the settings of the heating). The twist in the plotlines of “The Big Bang Theory” compared to other sitcoms is that deal with the lives of a group of friends (for example Friends, How I met your mother etc.) is that they are all scientists (plus an engineer) and they all fit the stereotype of the socially awkward nerd, who is enthusiastic about computers and science, and the problematic of their lives often incorporate science and technology.

It is apparent from the beginning that the characters have a very strong identity as scientists; they have a peculiar way of speaking and they are constantly referring to things that the audience might be unfamiliar with. Also, there is science and/or technology presented in various ways and incorporated in almost every scene. The plotlines are based in “everyday” situations of either their private or professional lives (for example competition in the work place), trouble with friends and family, health issues etc… Those situations are usually relatable for the audience and become funny in the way they are acted out by the seemingly awkward characters.

One of the main settings is the university Leonard, Sheldon, Howard and Raj work in, including their work spaces. The audience is therefore exposed to various departments, laboratories, workshops and equipment that are part of the “university research experience” shown in the segments of the series that take place in a setting within the university. On the other hand, Leonard and Sheldon’s

apartment often serves as the set for experiments as well. In both settings "science takes place" so to say, which basically means that they would do different sorts of experiments or activities that incorporate science as well as technology. The degree of seriousness with which these experiments are done, varies according to the setting though (the more dubious experiments are always conducted at home).

It is still important to keep in mind that it is a fictional story nonetheless. The fact that it features scientists' works in favour of this specific show, but the fact that they are scientists is not a guarantee that it would in fact be funny and interesting to watch. In fact others have tried to sell the idea of featuring scientists in a television series and failed because scientists as well as nerd characters are not necessarily perceived as being interesting characters (Dreifus 2013). What has made the show successful was the fact that the characters apparently are very relatable to the audience; the general perception of the scientists seems to be that of ordinary people doing something that principally anybody can do and have fun with (Pain 2013); it's about what it's like to be an outsider (Dreifus 2013), a feeling that audience members certainly may be able relate to.

## 4.3 Communicating with /to the audience

As I have pointed out before, one of the main points in communicating with an audience is to know the audience: the demographic, the culture and the social background etc… The target audience of a sitcom can be very broad. Especially sitcoms like "The Big Bang Theory" have to be family friendly because they are shown during primetime and they are aired in form of reruns during daytime programming as well. They are watched by people with different social as well as cultural backgrounds, people with different degrees of education, teenagers as well as businessmen. The basic sitcom audience can be seen as a cut through society at large. There are very few other tools that address such a variety of people other than a television program aimed at their entertainment.

Essentially, exposure to such a diverse audience is what makes the sitcom a good complement to more classical forms of science communication. It can only ever be a complementation because it remains unclear how the information was obtained, who specifically came up with it and under which circumstances certain claims can be made. Even though the scripts for "The Big Bang Theory" are fictional, they are constructed with mundane knowledge about normative practices and therefore rely on the audience to have the same in response (Stokoe 2008). This doesn't mean that the audience is expected to be able to grasp the scientific content; but it shows that there are different ways of looking at the jokes and stories written as they are written by people that may have the scientific knowledge but also have to have the tools to create humour.

Talking about Twitter, for example, as if everyone has detailed knowledge about it excludes viewers from the pun referred to. Jokes can still be funny even if the content is not understood (that is where decent actors come into place). The art of writing a sitcom means therefore to be able to not bore technologically/scientifically knowledgeable people with too broad content while at the same time exceed the attention of viewers which are not knowledgeable of the specifics.

## 4.4 The sitcom and its artistic freedom as a complementation to science communication

Thinking about the range and variety of sitcoms, it is interesting to observe that most of them revolve around the same core issues: friendships, family, relationships, etc.; occurrences in everyday life. A sitcom is about finding humour in situations based on reality, stressing points, moments or comments that in their togetherness create something which may widely be considered as being funny. The laughter generated in these situations is often rooted in the juxtaposition of "appropriate" and "inappropriate" ways of behaving in a course of action (Stokoe 2008).

One of the interesting points of the sitcom as a genre is that it does not incorporate negative feelings. As its main focus is to entertain, gloomy emotions are left out at the very beginning. Nothing should keep the audience from enjoying the twenty minutes of distraction any sitcom promises to trade for the viewer's attention.

But is it a good idea to incorporate science and scientists, more "serious" entities, into something that is meant to purely entertain? Serious communication and comedy are not mutually exclusive; science and scientists can be a source and inspiration for a lot of jokes, puns and situational comedy without having laughter dismantle the argument. In order to reinforce their social and professional in-group identity, the community of nerds portrayed in "The Big Bang Theory" make use of linguistic strategies (Balirano 2013). While these strategies are a way of reinforcing their group identity (Balirano 2013), they simultaneously can be an opportunity for laughter. When Sheldon uses a reference to Entropy in order to point out how messy Penny's apartment is, there is laughter because people understand the reference or because they are amused by the way he points out the obvious; in any way the point Sheldon's character makes is valid and funny.

The medium of the sitcom clearly has its advantages as well as its disadvantages, but it paints a happy picture and it sells a certain kind of (positive) image. Science appearing in other forms of television entertainment (for example drama series) has a disparate image than the one portrayed in the closed space of the sitcom. The lead character in the drama series "Breaking Bad", in which a chemistry teacher becomes an illegal drug manufacturer, tells a whole different story of what science can do than the character of Sheldon does.

What can be heard and seen is part of the conception of that specific genre, while negativity is not an element of a sitcom; to be lightly entertained is not why people like to watch drama series. People choose to watch a specific kind of genre and like the genre to remain what they believe it to be.

When communicating and promoting science, for example in the form of a science fair, the whole set-up has to be professional, or at least appear legitimate. While it is ok to show unconventional products or experiments, the overall message has to be that science is a profession, that there are serious issues to be tackled with science and technology; that there is a specific purpose in it. The "fun" approach that is often shown in promotional campaigns appears to be crucial as the reputation of science often seems to be that it is "boring", yet most of those popularization efforts seem rather misplaced, because in the end having "fun" with science is not going to cure cancer, broadly speaking. Maybe that is why "in real life" communicating science is a serious matter.

But when science is the setting of a sitcom the main focus is switched as it becomes a matter of television. On television the depiction of reality is not necessarily supposed to be accurate. Even when it is, there are still things that can be done, that would be unimaginable in "real" life.

In one of the first scenes, I have ever seen one of the characters pulls a banana out of a liquid nitrogen tank, smashes it with a hammer, scatters it on a bowl of muesli and eats it in the laboratory. While the whole situation is funny to watch, this kind of behaviour is highly unprofessional. The fact that you don't dry-freeze your food in the same container as your samples is unacceptable in real life, but if someone does it on television in a fictional television show there is not a lot of outcry. In the end there are no consequences for having fictional characters in an entertainment show behaving inappropriate and unprofessional.

Because of the light heartedness of the genre, criticism can be voiced without sounding like criticism by putting it in a joke or stating it out bluntly enough to seem unreal. If the writers like to include current topics within the scientific community into the storylines and accidentally or purposely voice criticism, it is acceptable. The sitcom in general has the power to ridicule and tease, because there is not the expectation for it to be accurate. Fiction has the advantage of being able to present a controversy in a less balanced way (Mutz and Nir 2010), the emphasis is on providing the characters with situations in which they can act and create laughter rather than on laying out the problematic of a situation or controversy. To publicly voice an opinion on certain scientific findings and technological developments on television formats like the news or other media, is a lot more difficult.

Another thing the format of the sitcom can easily portray, as opposed to other formats, are "absurdities"/occurrences that seem very normal within a certain setting but look completely different from the outside. An example for this would be the episode "The Jerusalem Duality"

(Season 1 Episode 12) in which Sheldon faces competitive pressure from another genius half his age who disapproves of his theory or the episode “The Benefactor Factor” (Season 4, Episode 15) where the main characters have to attend a fundraiser in order to acquire funds for their projects, both of them illustrating situations that scientists may be familiar with but are quite exaggerated, which often shows and questions what people often are willing to do.

Certainly, the main advantage of incorporating science into a sitcom is that there are no limits to what can be done. Even though the series is meant to look realistic, it is not required to be one hundred percent accurate. If they choose to send an average engineer to space, they do it. They also let the characters steal military equipment and get away with it or invent a new element. This is the place where dreams can come true, because there is no expectation to stick to reality. Everything is possible and while that is often promoted in other science promoting efforts as well, the sitcom is the only place where it actually is.

# 5. Analyzing the unfolding of a single episode

As pointed out already, the following chapter gives a chronological description of the happenings, settings and characters involved in one specific episode of "The Big Bang Theory". The aim of this chapter is to show how a single episode unfolds, how it is structured and how certain topics are addressed. This procedure illustrates how issues related to science, scientific knowledge and being a scientists are intertwined in this fictional story.

The episode chosen is "The Cruciferous Vegetable Amplification" (Season 4, Episode 2) as it features technology (the "mobile virtual presence device") and its implications as the main topic of the plot and includes the "nerdiest" of the main characters as the lead.

The main plot of this episode revolves around Sheldon's efforts to elongate his life. His first hypothesis is that in order to achieve a longer life, he has to lead a healthier lifestyle. But his attempts fail. Therefore he decides to reside in the safety of his room and interact with the outside via a virtual presence device that will serve as a representation of him in "the real world". That way he would be able to live his life without the possibility of dying due to unforeseeable circumstances (an accident for example).
The most important characters in this episode are Sheldon, a highly intelligent and rather odd theoretical physicist, as well as his roommate Leonard, an experimental physicist, and Penny, their neighbor.

## 5.1 Sheldon's wish to elongate his life

The very first scene of the episode "The Cruciferous Vegetable Amplification" starts with Sheldon standing in the middle of his living room writing on a white board. There are four boards in the living room; they are arranged in a half circle. The biggest board, which Sheldon draws on, has equations and some sort of timeline on it. The one next to it shows a graphic and a few more equations. The third one has a big diagram on it and the last board looks a bit like a scheme of a process or something similar.

Only the first white board is standing on a holder, the others are either on the floor or on a chair, stabilized with thick books. On the coffee table books and notebooks are spread, some are open some closed, all of them showing in the direction of Sheldon, which gives the impression that he looked something up while he was writing on the boards (see Figure 4).

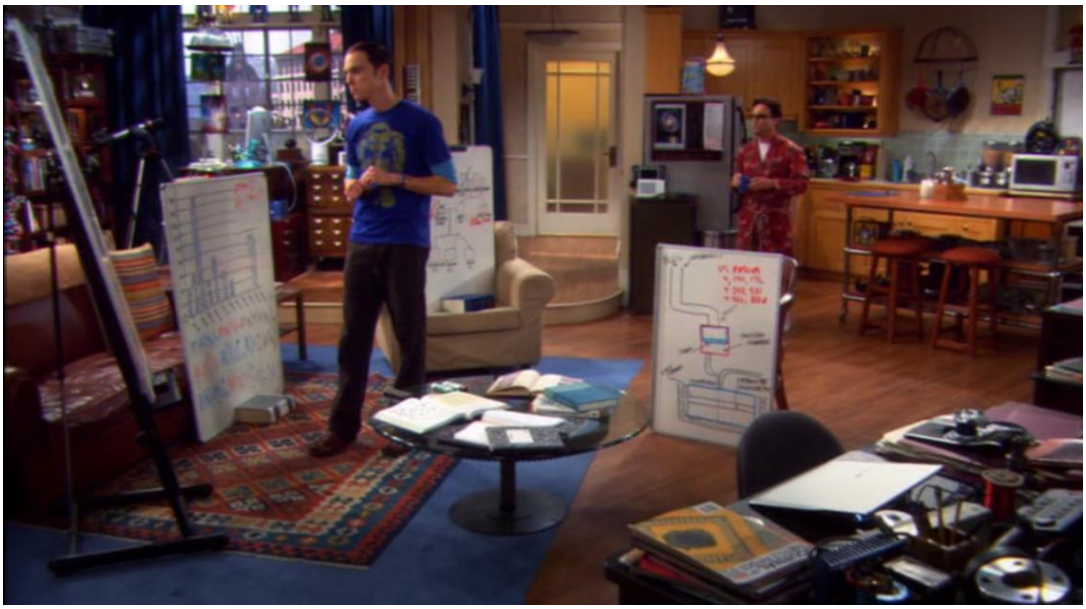

**Figure 4 Sheldon (left) is standing in front of various whiteboards, Leonard (right) observes (The cruciferous vegetable Amplification, 2010 ©Warner Bros. Entertainment Inc.)**

The rest of the living room looks rather average: in the center there is a big couch, a coffee table, an armchair and an ordinary wooden chair forming a half circle (from other episodes you would know that the couch faces the TV but it is not shown in this episode). In the background you can see about four book shelves filled with books and other things (e.g. a globe, different action figures). It is hard to say what kinds of books actually are on the rack; only on one rack the titles ("Norton 365") are clearly readable.

Also in the background but easier to spot is a telescope facing the window, which is decorated with what looks like pictures of stars or galaxies or the like, and a huge replication of a DNA helix. At least that is what it can be described as: a helix, made of those little balls that are used in chemistry class to rebuilt chemical bonds. Next to the window there is also an office table with a computer on it. On the wall you can see a whiteboard hanging on a door with some equations and a sketch on it.

Aside from the whiteboards in the very first frame, the living room/apartment appears to be rather average at first sight. The details nevertheless suggest that the inhabitants of this place have an interest in particular things as well. While it is not uncommon to own a telescope, having it placed right next to the window, where it is close at hand and surrounded by pictures of stars is rather unusual. The fact that it is set close to a helix sculpture and a whiteboard full of equations is another clue to the interests of the inhabitants. But apart from giving clues to its residents, the details of this set also suggest that science and technology are in one way or another embedded into the characters' lives, which is probably most visible because of the desks in the very front of the set. They are rarely in frame in this scene but usually more prominently placed and stacked with different materials, tools, books and papers.

Sheldon is fully dressed, while Leonard enters the living room in his bathrobe. He curiously looks at Sheldon while walking into the open kitchen and pouring himself a coffee. It looks as if he just got up while Sheldon must have been awake for a while already. As Leonard asks him what he is doing, the audience could assume that the boards have not been there the night before. Leonard makes a joke which Sheldon does not think is funny (at least he does not laugh) but he starts to explain what he is doing:

**SHELDON**
What I am doing here is trying to determine when I am going to die.

**LEONARD**
Hm hm. A lot of people are working on that research.
So what is all this?

**SHELDON**
My family history factoring longevity, propensity for disease, et cetera.

**LEONARD**
Interesting.
Cause of death for Uncle Carl KBB? What's KBB?

**SHELDON**
Killed by badger.

**LEONARD**
How's that?

**SHELDON**
It was Thanksgiving. Uncle Carl said: "I think there is a badger living in our chimney. Hand me the flashlight" Those where the last words he ever spoke to us.

**LEONARD**
I don't think you need to worry about death by badger being hereditary.

**SHELDON**
Not true. The fight or flight instinct is coded genetically. Instead of fleeing he chose to fight barehanded against a brawny member of the weasel family. Who's to say I don't share that flawed DNA?

**LEONARD**
We can always get a badger and find out.

**SHELDON**
[fakes laugh]
But seriously even if I disregard the Uncle Carl factor, at best I have 60 years left.

In these first few minutes the audience gets an idea of both the main plot as well as the characteristics of the leading characters. As Sheldon explains the current situation as well as the events leading up to it, the audience might notice the differences in the way he talks in comparison to the way in which Leonard talks as well as the kind of terms and articulations he uses. Both of them do not seem to have an accent or dialect; they do not seem to have speech impediments either and

while Leonard's vocabulary does not show any specificity, the way Sheldon expresses himself might allow for further indications concerning his educational background.

This interaction points to the way Sheldon deals with problems: he turns them into mathematical problems, which he is able to solve. It's the first moment in the episode this happens, but there will be other instances following that will display the same aim. This is also the first instance of scientific knowledge being part of the storyline, even though it is hidden between the lines.

The scene continues with Sheldon telling Leonard that he only has sixty years to live and that this would be too little time for him to reach a certain point in his time line:

> **LEONARD**
> What's there?
>
> **SHELDON**
> The earliest estimate of the singularity. When men will be able to transfer its consciousness into machines to achieve immortality.
>
> **LEONARD**
> So you are upset about missing out on becoming some sort of freakish self-aware robot?
>
> […]
>
> **SHELDON**
> You don't get this Leonard. I am going to miss so much. Unified field theory, cold fusion, the dogapus.

In this part of the scene Sheldon gets very specific on why he is determined to find out when he is going to die. Sheldon wants to live to be able to reach singularity. Singularity is the first term that is more specific, a term which members of the audience might be unfamiliar with. Sheldon explains it in the next sentence:" When man will be able to transfer its consciousness into machines and achieve immortality"; the way he phrases this is rather technical, so Leonard breaks it down for the audience once more: Sheldon wants to become a "freakish self-aware robot" because he wants to be able to experience things such as unified field theory, cold fusion and the dogapus.

In this sequence Sheldon uses as term which is quite specific ("singularity") and it cannot be assumed that every viewer will be familiar with this term. What is done now (and almost every time similar situations occur) is that the counterpart in the conversation rephrases what was just said. In this case Leonard asks a question to clarify if he understood Sheldon and uses vocabulary which is easier to understand and follow.

## 5.2 Cybernetics + a healthy diet= a longer life?

The second scene commences with four people (Leonard, Howard, Raj and Penny) sitting in the living room. At this point the white boards are gone and instead of notebooks there are pizza boxes on the

coffee table. The first unusual thing that happens is that Raj is not directly involved in the conversation. Instead he whispers into Howard's ear while Howard has to tell the others what Raj has told him. The reason for this behavior is later explained as his inability to talk to women and as Penny is present he can't actually participate in the conversation.

The four have a conversation about who has to pay how much money for the food they ordered when Sheldon enters the living room. Leonard asks him to chip in for the pizza; Sheldon informs them that he won't have pizza anymore:

**SHELDON**
No, thank you. I'm not eating pizza tonight.

**PENNY**
But it is Thursday. Thursday's pizza night.

**SHELDON**
Not for me. Thursday is now cruciferous vegetable night. Tonight's selection: Brussels sprouts.[…]
In order to live long enough […] I need to change my diet.[…]
I am also planning to begin an exercise regimen design to strengthen my cardiovascular system, aka jogging.

Sheldon started to covert his plans into reality. What the audience might not know from having just looked at this specific episode is that the friends and especially Sheldon's recreational time and food are planned out and consistently the same, regulating what they do and eat. And the fact that Sheldon decides to change that comes as a surprise. But he has a reason to do so as he wants to elongate his life. Now the audience learns that he thinks eating vegetables will help him to do so. But he did not choose just any vegetables, he chooses cruciferous vegetables.

This specificity is one of Sheldon's character traits, but in variation it is visible in the other characters as well. If the first scene stages Sheldon as some kind of "mad" person, this scene manifests the claim. The way he articulates himself is exemplary for his way of speech as well as for the vocabulary he uses.

Sheldon's elaborations on a healthy way of elongating his life are contrasted by the reasons to engage in those practices in the first place:

**SHELDON**
In order to live long enough to fuse my consciousness with cybernetics, I need to change my diet.

**PENNY**
Wait. Cybernetics is robot stuff, right?

**SHELDON**
Correct.

**PENNY**
So, you want to turn yourself into some sort of robot?

Sheldon introduces the term of cybernetics and again another person is explaining the term in their own words. While he is using more sophisticated terms, the other characters reduce his notions to the fact that he wants to be some sort of robot in the end. As this is the second occasion Sheldon talks about elongating his life, the general intention of Sheldon's behavior should be obvious for the whole audience at this point. This again is one of the instances where technological and scientific knowledge is mentioned in form of vocabulary.

As the scene continues, the friends are discussing that Sheldon should go jogging with Penny (apparently to his pleasure and her displeasure) and Raj's inability to talk to women becomes visible as he cannot defend himself when Howard refuses to pass on Raj's input. This kind of behavior is sometimes seen as typical for "mad scientists", even though at this point it is not actually apparent that the characters are scientists yet. At least there has not been a sound argument for it apart from the odd whiteboards in the first scene. The behavior of Raj and the issue of the "mad scientists" will be further discussed in chapter 8.

## 5.3 Sheldon might be a scientist, but he is also a hypochondriac

The third scene follows the results of Sheldon's change in diet:

> **SHELDON**
> I have pain radiating from my navel to my lower right abdomen. I'm nauseated and feverish. I believe I may have cholera.
>
> **LEONARD**
> There's no cholera in Pasadena. Just like last summer, when there was no malaria in Pasadena.
>
> **SHELDON**
> Well, if it's not cholera, then based on a quick internet search , the other explanations in decreasing order of likelihood are Hirschsprung's Disease, botulism, a 30-foot tapeworm or accidental ingestion of chrysanthemum blossoms.

Sheldon is very articulated in describing his pain. He has pinpointed it in a specific location and in his opinion he also shows symptoms of potentially life threatening diseases. After his initial description he immediately claims to have cholera, which could be argued makes him into a hypochondriac. A claim that is reinforced when Leonard points out that there are neither cholera nor malaria to be found in Pasadena. Still Sheldon insists that it must be a possibly deathly disease, at least according to the internet. As he is so persistent, Leonard suspects that he might actually be sick and suggests they go to the hospital in order to check whether or not Sheldon might have appendicitis.

This scene shows an interesting turn of events, as it turns out that the very articulated, well informed character of Sheldon is in fact a cyberchondriac, which is a paradox development given that he is a scientist and "should know better". It is also a moment in which the "dramatic tension" starts to

build as Sheldon's first attempt to improve his health with nutrition has failed which opens the door for other attempts.

The most important issue in this sequence in terms of science and technology is the fact that Sheldon turns out to be cyberchondriac. The fact that an educated and intelligent scientist can be worried about his well-being by claims he read online is going to be an issue in chapter 6.

## 5.4 Running and biomechanics

The following scene is set in the hallway between Sheldon/Leonard's apartment and Penny's apartment. The setback with the Brussels sprouts is already forgotten when Sheldon and Penny have arranged to go running together. Sheldon is dressed as he would normally be dressed (a shirt with long sleeves under a shirt with a reference to a comic book) only that the wears shorts (which cause Penny to make a joke). While he knocks at the door he runs on the spot and continues to do so during the following conversation:

**SHELDON**
Where's your heart rate monitor?

**PENNY**
I don't have one.

**SHELDON**
What about your pedometer?

**PENNY**
Don't have one.

**SHELDON**
Do you have telematics in your shoes connected to an iPod?

**PENNY**
Uh, no.

At this point Sheldon stops running on the spot (certainly in order to emphasise his confusion).

**SHELDON**
What do you do, you just go out there and gambol about like a bunny?

This may be the moment Sheldon's attachment to technology becomes even more apparent. Sheldon needs equipment in order to measure his heart rate, the distance and other statistics. He didn't even run at this point, yet he would be able to measure his success with the help of technology and mathematics. Just like his approach to break down a personal problem into a mathematical problem mentioned in the beginning of this chapter, his attachment to technology is engraved in his character. It is also another touching point that allows an easy embedding of technology into the storyline which is going to be discussed further on as well.

Penny then turns to stretching which is one of the moments that create great laughter as Sheldon is not able to mimic her movements. This plays well into the stereotype of the unfit nerd that only "does " sports when playing Olympic games on a games console. They start running and step down the staircase. As both of them are out of sight the audience can still hear Sheldon talking:

> **SHELDON**
> Yeah, I've been reading up on biomechanics. I think you'll be surprised at my … [yells and sound of him falling down the stairs can be heard]

Now the audience knows that Sheldon is not just up to date with the latest technology used to enhance physical abilities in order to be prepared for this activity, he also reads up on biomechanics, to inform himself about what exactly is going to happen to his body. It does not come as a surprise that he is overly prepared; it is more or less expected of him. Still he stumbles and falls.

This moment is important in terms of its placement within the story. It is the point that the tension has built up to. Neither nutrition nor exercise helped Sheldon to lead a healthier live, if anything, they failed him. But also the additional help with the pedometer and the heat rate monitor has not prevented him from falling, which also emphasises the point that technology does not prevent mistakes. This will also be an issue in chapter 6.

## 5.5 The mobile virtual presence device

The fifth scene brings the viewer back to the apartment. Penny, Raj, Howard and Leonard are sitting around the coffee table unpacking the food they ordered for dinner. The living room still looks the same only that there is what looks like a ramp in the back instead of the stairs separating the living room from the rest of the apartment. As Sheldon is missing for dinner the friends call for him. He appears, but not as his usual self. A big black box on wheels, connected to a TV screen via a pole on top of the box has Sheldon's face on it and a clothes hanger with a t-shirt hanging beneath the screen, wheels into the living room. Suddenly the purpose of the ramp becomes apparent.

> **SHELDON**
> Greetings, friends.
>
> **LEONARD**
> Greetings, whatever the hell you are.
>
> **SHELDON**
> I am a mobile virtual presence device. Recent events have demonstrated to me that my body is too fragile to endure the vicissitudes of the world. Until such time as I am able to transfer my consciousness, I shall remain in a secure location and interact with the world in this manner.

After having slipped and falling down the stairs he is even more anxious for his life. He is even more afraid of hurting himself so he prefers to stay in a place he thinks is save and intents to resume his

life with this device. He calls it “mobile virtual presence device”, a term that will be used for it in here as well.

It is a bit difficult to classify whether or not it can be said that Sheldon or the mobile virtual presence device is talking. While it is apparent that the person on the screen is interacting from a distance so to say (as not in the same room) the person is still visible on the screen. It appears as though Sheldon is there and not there the same time. Given that the device is also “dressed”, it is tempting to say that even though he is not physically present, it is Sheldon who is in the room. Yet Sheldon describes the situation differently: By saying “I am a mobile virtual presence device” he is drawing a clear distinction between his physical body in a “secure location”, and this device in the living room representing him.

Interestingly, he points out that this device is not him, but Sheldon still insists on sitting in his spot, a place he initially choose to improve his bodily well-being. And even now, while he is not even able to “sit” in the first place, he still demands his spot although due to the technology he “is” now, he could sit in any available spot.

Once Sheldon wheels in, the audience is waiting for the reaction of his friends. While they are certainly surprised which can be seen in their faces, the background laughter also indicates the ridiculousness of the situation. But the second Sheldon insists on having his spot; “old” Sheldon is back and the obedient behavior of his friends sets back in when they slide to the side so that Sheldon can “take a seat”.

Nevertheless the scene commences and everyone is gathered around the table eating dinner including Sheldon in form of this virtual presence device. It looks almost as if that was the most natural thing ever but still the fact that Sheldon watches over them from a TV screen is a little awkward. Something that Sheldon is well aware of:

> **SHELDON**
> [… ]This may seem a little odd at first, but over time you’ll grow accustomed to dealing with me in this configuration.
>
> **PENNY**
> Yeah, to be honest, I don’t see much difference.
>
> **SHELDON**
> Thank you. That’s what I was going for.

Penny’s remark creates a lot of background laughter. The fact that Sheldon is not actually present does not keep him from doing/saying all the same things he would and at the same time they are all talking with a TV screen.

The mobile virtual presence device brings new aspects into the storyline its introduction opens up different possibilities for the episode to unfold. Yet it is not just important because it is the only technology which is further discussed within the episode, it is also an indicator of how tight and still clever technology is woven into the storyline.

## 5.6 Driving a mobile virtual presence device through university

If one is not familiar with the series, one might not know exactly where the next scene takes place at first sight. It looks like a hallway, linoleum floor, artificial lighting, pale colors on the wall and doors on each side and a big exit sign; it could be an office building etc… The decorations on the wall may give you a more specific clue: a poster that appears to show a table of wavelengths and also another poster with something that looks scientific as well. Scientific, because the muted colors, big graphics and precisely structured blocks of text give the implication of "serious" content.

But while Leonard and Sheldon (still in form of his virtual presence device) walk along the hallway their location becomes a little more concrete as Sheldon greets the people passing by

> **SHELDON**
> Hello, Professor Hoskins. Nice to see you Mindy. Konichi-wa Dr. Nakamora. Sorry the Swedes disproved your theory.[…]

The first indicator is that they meet a professor and a doctor in the hallway. The second is that Sheldon points out that Dr. Nakamoras theory has been disproved by people in Sweden. Apparently, this was not a theory that was simply made just like everybody once in a while comes up with a theory about something otherwise people on another continent would have been going to the process of disapproving it. The fact that Swedes are mentioned may be a reference to the Nobel Prize Committee which can be seen as a last indicator that Leonard and Sheldon are in fact walking along the corridor of the university they work at after all.

Supposedly, if you have not seen anything but this episode you might assume that the main characters could be students as well, a judgment stemming from the way they are dressed on the one hand and the way they behave on the other. Their appearances certainly fit the roles they are attributed to, yet I think that looking at them in the light of figuring out who they are from scratch shows how difficult it is to place them. They certainly could be students, but they would also be credible as researchers, they could be artists just as much as social workers. It is only in the context that it is possible to identify them as researchers.

This sequence gives another insight into the look and detail of both the setting as well as the visual appeal of the main characters. It is an example for the fact that the stereotypes at work in this specific series are different to those that used to be at work when talking about science and

scientists. They do not wear lab coats and they don't stand behind bubbling petri dishes, which makes it a bit more difficult to identify them as distinguished scientists rather than "old" students.

## 5.7 A problem occurs

When Leonard and Sheldon reach the door to Sheldon's office, a problem occurs that Sheldon obviously did not think of when he put the plan together of acting as a virtual presence devise:

**SHELDON**
Leonard, my door.

**LEONARD**
What about it?
[…]

**SHELDON**
You think you got me stymied, don't you?

**LEONARD**
No, I think a doorknob has you stymied.

While Sheldon thought about the device having to be able to being disassembled in order for Leonard to carry it out of the apartment, and having a backup in case someone turns off the screen and building a ramp on the stairs in their apartment, Sheldon forgot that there are certain obstacles in his daily life that quite literally need an "extra pair of hands". Even as an "enhanced" technological device, Sheldon is still dependent on his friends fixing things for him, in this case to open the door. Still Sheldon would never admit that his plan or its implementation shows one or more flaws, that's why he suspects Leonard of stymieing him of entering his office. But as Leonard points out to him, it is the doorknob, a really tiny obstacle that keeps Sheldon out of his office.

It turns out that even the most sophisticated technology can have its downfalls. Sheldon's character is very much fixated on technology as a means to solve his problems, but occasionally technology is not the answer to every obstacle in life. Also, life often requires certain flexibility in order to "move forward" and one single scientist working by himself is not going to be able to think of every scenario his technology might find itself in.

## 5.8 Eventually, being a mobile virtual presence device is a disadvantage

The last scene commences with the guys sitting around a table in a restaurant. Sheldon is still represented by his mobile virtual presence device. Penny enters the scene as their waitress. She takes their order but refuses to serve Sheldon as he is not actually there to either drink or eat. Sheldon protests by saying her behavior was "discrimination against the otherwise located", he automatically elongates the rack that holds his screen to shout for the manager to complain as he spots Steve Wozniak sitting on one of the other tables. Sheldon is mesmerized. Leonard tries to

explain to Penny who Steve Wozniak is, but she stops him saying that she knows, as she watched him on “Dancing with the Stars”.

Sheldon in his mobile presence device wheels over to Steve Wozniak to tell him, that he is a big fan:

> **SHELDON**
> One of my proudest possessions is a vintage 1977 Apple Two. Despite the file system limitations of Apple DOS 3.3, it was a pretty nifty little achievement.
>
> **STEVE WOZNIAK**
> Thanks, we were shooting for nifty. You know, if you had it here I’d autograph it for you.

Certainly one of Sheldon’s features is that he talks very explicitly about technical things like the Apple Two and then concludes his remarks with words like “nifty”. But, apparently, to Steve Wozniak this does not seem odd. Even the fact that he is talking to a mobile virtual presence device does not seem weird to him, he talks to the Sheldon on the screen as if he was a real person. Sheldon seems satisfied with the situation until Steve Wozniak tells him that he would sign the Apple Two if he would have it here. At that moment he realizes that the mobile virtual presence device does not do him any good, and that he has to run to the restaurant with the computer in his own hand in order to get this signature.

So he does and on the way he falls down the stairs again and breaks his computer. So the virtual presence device could not save him from getting hurt in the end after all.

At this point the story ends. Sheldon has abandoned the technology in a “heat of the moment” decision and ends up being hurt after all. The story arc follows Sheldon’s efforts to elongate his life, at first with exercise and a healthy diet and later by replacing himself with a robot like machine. In the end none of those efforts can prevent him from slipping on the stairs. This specific episode shines a light on the character of Sheldon and examines how he tries to use technology as a means to solve any kind of problem.

This kind of problem solving/attachment to technology is one of the main issues that will be reflected in the following chapters along with the use of language, the “mobile virtual presence device”, the setting of experiments, visualizations and the role of humor. What is also very apparent in this exemplary episode is the factor of the setting and the characters as they carry the story as well as visual and textual impulses. Both of them are going to be discussed in separate chapters as well.

# 6. Main Issues

The following chapter presents different issues that mostly have been identified within the example episode “The Cruciferous Vegetable Amplification”. They are divided into three groups: The first group deals with issues that relate to the direct experience of the audience with the sitcom and the science and technology aspects of “The Big Bang Theory”. Further attention will then be given to topics which are not clearly visible but arise in the course of the story and the interaction of the characters. The last group elaborates on the specifics of the behavior of the main character Sheldon and the status of laughter within this sitcom and the context of science communication.

## 6.1 Visual and audible references to science

### 6.1.1 Terminology – playing with language

The first encounter with science in terms of spoken words occurs within the first scene of “The Cruciferous Vegetable Amplification”. The vocabulary that Sheldon uses to explain and elaborate the drawings on the whiteboard is somewhat more “specific”. He uses terms like “unified field theory” and “cold fusion” which assumingly not the whole audience is familiar with. Language is an essential part in a television series in order to transport content as well as humor, yet the setting of this particular sitcom requires a slightly different approach to language and terminology than sitcoms based in a less specific environment would.

The characters have their own way of speaking and their own basic vocabulary and there are differences in the way they talk depending where and who they are in conversation with. In this episode Sheldon is the only person using specific vocabulary, yet in other episodes it is obvious that Howard, Leonard and Raj often use the same kind of “foreign vocabulary” when gathered around curious machinery or discussing a scientific problem, yet they would never use it when discussing trivial and personal matters. Sheldon’s character is allowed to use this kind of specific language anywhere, at any times no matter whom he addresses because that is part of his character description.

The problematic with using specific terms and vocabulary is that there may be viewers who are unfamiliar with and intimidated by it. The medium of the sitcom has an advantage in this regard as opposed to e.g. a conventional science magazine on television where they might discuss the very same topic: humour. The main goal of the whole series as well as the main focus of every episode is to make the viewer’s laugh; that they might pick up the one or other fact or some knowledge about science or technology is only a bonus. So while not all technical terminology or every science joke might be easy to follow or even understandable to the entirety of the audience, there is humour

even when understanding them. The jokes work on two levels: as the jokes based in scientific or technological knowledge, like intended, but they also make space for laughter indicating that the joke did not work for people unfamiliar with the language.

The use of scientific language is not only a means to create laughter; it is an essential to illustrate the community of people as well. They share a language they speak amongst themselves, which is why Penny doesn't laugh at their jokes and why lay people often don't see what is funny about a scientist's joke. In representations of scientists, scientific and technological language is used as a foreign language that has to be translated (LaFollette 1990).
The example episode ("The Cruciferous Vegetable Amplification" Season 4 Episode 2) in the previous chapter shows rather nicely how the translation of scientific language is done in "The Big Bang Theory": whenever Sheldon explains something, someone rephrases it in more understandable words.

For example:

**SHELDON**
[…] The earliest estimate of the singularity. When man will be able to transfer its consciousness into machines to achieve immortality.

**LEONARD**
So you are upset about missing out becoming some sort of freakish self-aware robot?

Another example:

**SHELDON**
In order to live long enough to fuse my consciousness with cybernetics I need to change my diet.

**PENNY**
Wait. So Cybernetics is robot stuff, right?

(Both from "The Cruciferous Vegetable Amplification" Season 4 Episode 2)

As Sheldon is the character using scientific vocabulary and language extensively his contributions to a conversation often have to be "translated". In these two examples it can be seen that Leonard and Penny rephrase what Sheldon said by putting it into a question which makes it seem less like a translation, yet it clarifies the things Sheldon had said. It keeps the rhythm of the conversation and interaction in stroke to construct the dialogues in a self-explanatory fashion by making the characters lay out the less obvious vocabulary/terms.

The language used is also an indicator for their profession. The fact that they use scientific terms and technical descriptions reinforces their stance as being "weird" as well as being "smart", both of which are stereotypically attributed to scientists (Frizzoni 2004; Flicker 2004). Not everyone using this specific terminology is automatically a scientist, but it does mark a certain affiliation.

The humour arising from terminology/ vocabulary is often based on the fact that people do not understand it. The audience laughs because they have no idea what the characters are talking about. It's funny if you see that the characters are obviously entrapped in a fight but the content seems ridiculous when you don't know what they are fighting about. On the other hand, if the viewer does share the language and can follow the puns and references, the whole situation becomes funny for another reason. A group of people that do not speak the same language can still laugh about the same things.

### 6.1.2 Experiments

One thing that is fascinating watching the series is the fact that the characters always do some sorts of experiments at home. First of all the definition of "experiment" in this context is very broad; it can be anything from the attempt to cultivate bacteria on a jelly medium on the kitchen table to improving the toilet of a space station or connecting all electronic devices in the apartment to the internet so that someone in Korea can turn the lights on and off.

What can be seen in the series is that science, technology and knowledge are not always bound to a specific place but that they can be cultivated and nourished at the most bizarre places under various circumstances. Once again Sheldon provides a nice example. His work never ends when he leaves the university, he is always working on something at home and Sheldon would go out of his way to turn an experiment into something that is way bigger. In this episode he starts an experiment with a healthy diet, in another episode he tries to find a model for a theory he is working on, but he can't seem to find a fitting visual representation.
Howard's character is a good example for the presentation of "home- made experiments" as well. As the engineer of the group his expertise is often in demand outside of his workspace in order to fabricate and putting together the ideas of his friends. While Howard is the only one appearing to be "working" during scenes set in the university, he is also the one doing most of the manual labour in "home experiments" as well.

As Weingart et al. have pointed out "*Scientists working in their home basements are outsiders. They have isolated themselves from official science because they feel misunderstood, often because they are obsessed by their research, the questionable goals and methods of which they see justified by the expected success."*(Weingart, Muhl, and Pansegrau 2003). In a way you can see this kind of behaviour in "The Big Bang Theory" as well. The experiments they do at home would probably not take place in a university laboratory, yet they are rarely dangerous or controversial. They are rather "unprofessional" and therefore cannot to be done in a professional working space. But then again, the fact that they do participate in those kinds of illegitimate experiments may be reinforcing their

position as outsiders. But another thing about doing experiments at home is that there is no pressure to succeed. Failure will not be noticed.

In a way the fact that Sheldon replaces himself with a mobile virtual presence device is an experiment stretched out into the length of a whole episode. Sheldon experiments with was to elongate his life and uses certain scientific methods in order to do so.

### 6.1.3 Visualization

The first look into the apartment of Leonard and Sheldon in the example episode does not immediately reveal that it is the apartment of two scientists. Other than a laboratory the apartment of scientists is never featured in a stereotypical way. It does not look distinctly different than apartments in other shows on television either. Anyone could live in this apartment, yet there are a couple of props that could hint to specific interests of its inhabitants: the whiteboards scattered in the living room, a telescope next to the window, pictures of stars or galaxies on the wall and what looks like a giant DNA helix in the backdrop.

The other apartments do not have any clues like that. They are furnished in a way that reflects the inhabitant's nature: Raj's apartment has an "Indian look" (with a lot of patterned fabrics, pillows and oriental looking decoration), Howard has a lot of comic memorabilia and Penny's apartment is bright, colourful and messy. These apartments certainly are based on assumptions that people all over the world at any age would associate with the characters.

The most "scientific" looking places in the whole series are certainly the laboratories/workshops and the hallways of the university. The offices hold certain props, but taken out of context they would be identified as a scientist's office. The laboratories on the other hand are clearly identifiable as such, which might be because there is "only so much difference" between laboratories. As soon as there are people handling petri dishes, these spaces are identified as a laboratory and if there are people with googles soldering little wires, it might be considered an engineering lab. People sitting behind a computer on the other hand are more of a general visual reflecting an office atmosphere but nothing more specific.

The one object that appears to always transform the atmosphere from casual to professional is the whiteboard. It is very interesting to see how one specific object is able to set a different tone to a situation/setting, which is why, in the following section, I will give a more in- depth look at what whiteboards can do in this show.

- ***Whiteboards and equations***

Whiteboards are one of the things that are shown in practically every episode almost as to symbolize science in a way. In fact there is one whiteboard which appears in every single episode as it is

installed on the wall of Leonard and Sheldon's apartment with varying content. The content is usually presented in equations, diagrams or schematics but what is actually "written" on them it is rarely self-explanatory (at least not, if you are not able to process and evaluate them in a few seconds time). While they are usually filled with scientific content (e.g. mathematical or physical problems) they can be representations of more trivial problems as well.

The example episode opens with a sequence which shows Sheldon surrounded by four different white boards, all arranged in Sheldon and Leonard's living room. In order to figure out what the equations could mean, I typed them into a search engine online which provided me with the information that Sheldon must be doing something with probability calculus (Figure 5). As it turned out in the accompanying dialogue between Sheldon and Leonard who had entered the scene, Sheldon was trying to determine when he was going to die, considering pretty much every factor he could think of. So actually it makes sense that he would use probability equations to do so.

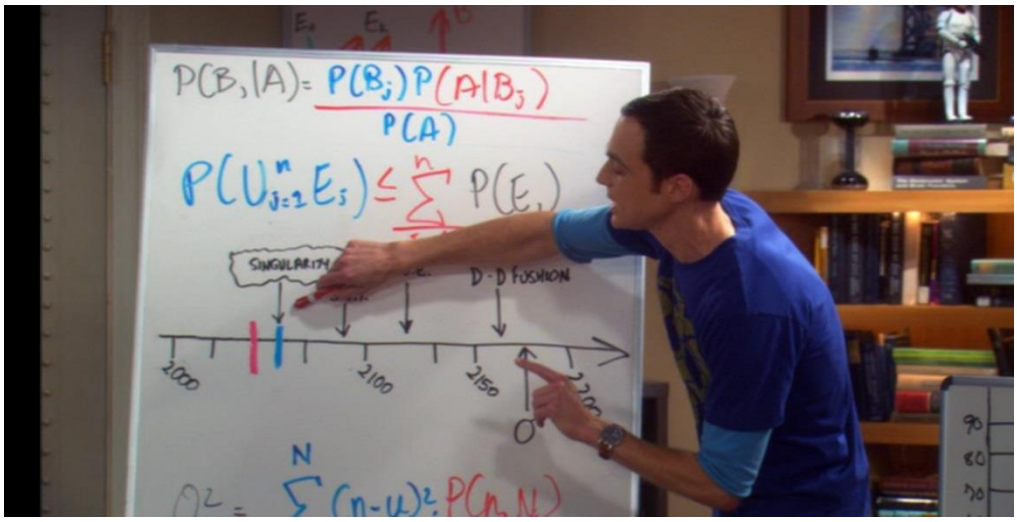


**Figure 5 Screenshot form the episode „ The cruciferous vegetable amplification"(2010 ©Warner Bros. Entertainment Inc.) featuring a "sensible equation"**

I named this kind of equations/diagrams/ schematics "sensible equations", because of the thematic it seems somewhat sensible to use mathematics to solve this specific question. There are others that are less sensible and carry a trivial message that is not related to the mathematical problems they would usually depict. For example there is another diagram which is supposed to represent the problem of having dinner and going to the movies (Figure 6). The problematic being that there is not one place where they could have dinner, have the perfect snacks and see a movie at a reasonable time  fills a gigantic whiteboard and makes up for a lengthy dialogue.

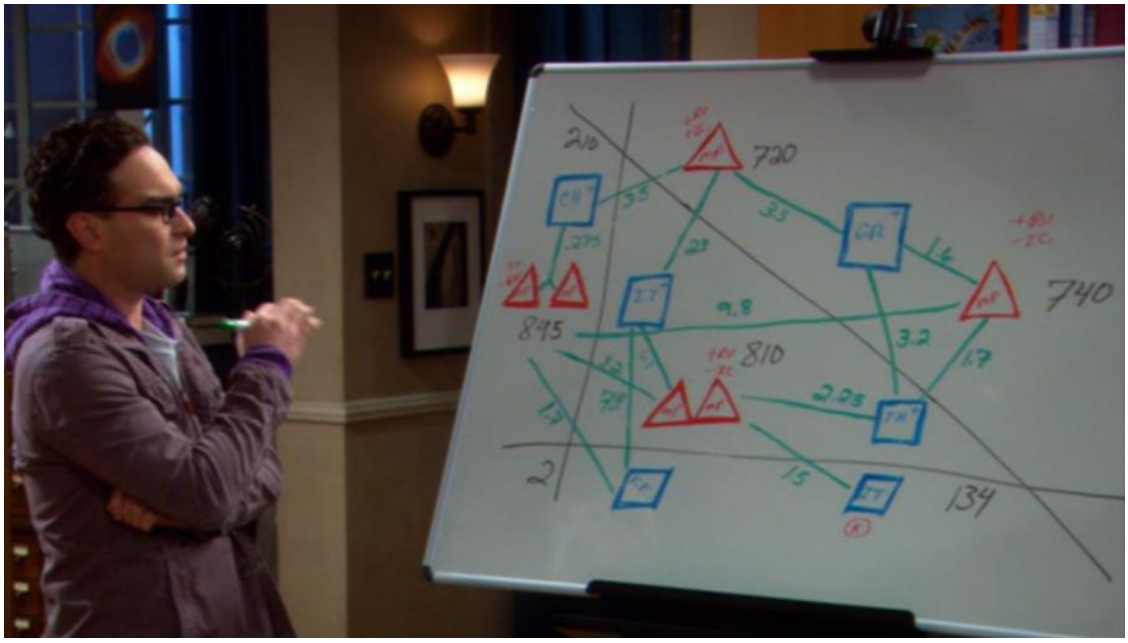


Figure 6 Screenshot "The financial permeability" (2009 ©Warner Bros. Entertainment Inc.) Leonard drawing on a whiteboard in order to solve a trivial problem

Most of the time, when the characters are directly interacting with the whiteboards (which mostly happens within the range of Leonard and Sheldon's apartment) the problematic depicted on the boards is one directly related to their personal lives. However the boards sitting in the background might have "real" mathematical/physical problems on them, for example the boards shown within the university. But it is not always equations which are supposed to help solving a problem. In another episode Sheldon is trying to find new friends and buys a children's book which deals with exactly this topic. Sheldon then translates the content into a flowchart which he then uses to make a new friend (see Figure 7 ).


Figure 7 Screenshot "The friendship algorithm" (2009 ©Warner Bros. Entertainment Inc.), Sheldon tries to make a friend using a flow chart

When the boards are filled with things that are supposed to be "serious", they usually are. As mentioned above the science consultant of the show David Saltzberg takes care of the "science" on the whiteboards. Asked about his task in an interview Saltzberg mentioned that *"There's a small community of viewers that reads those boards each week and there's treats in there for them"*("The Science of the Big Bang Theory » Scienceline" 2013) but apart from putting "insider" information on them, he occasionally includes controversial content as well. In another interview, Saltzberg explains that he sometimes put parts of his own work on the board which in real life was discussed as being controversial so the writers included a line to the original script to point out the uncertainty ("The Brain behind TV's The Big Bang Theory" 2013) and counterbalance possible outcry.

Actually the whiteboard is one of the key elements to why the series revolves around physicists. As one of the producers said in an interview, originally the characters were supposed to be software developers but then were switched to be scientists because they could draw on boards instead of sitting in front of computers (Pain 2013). This comment is a reminder of how visual television is and is supposed to be: it is important that the audience gets a sense of what is happening by simply catching a glimpse when they stumble upon by the program. Obviously, there has to be "visible action" in any television program, otherwise the audience would be bored which makes the whiteboard so handy because the scribbling, erasing, thinking and drawing can bring motion into a dialogue that otherwise would look rather dull.

These whiteboards along with the equations add a specific "scientific touch" to the situations they are shown in. It is interesting that the drawings are equations and the like; their visual appeal and scholastic character is that of a scientific tool. They represent the backbone of science which is being able to solve problems with mathematics etc. Equations and drawings are a language on their own, not everyone understands them and once again those that do, appear to belong to an "exclusive group" of knowledgeable people. Equations and whiteboards also hold a certain kind of expectation, namely that they hold scientific content which is why it is interesting that when those expectations are not fulfilled, the result is humor.

- ***Adding a professional touch to a private setting***

As Sheldon and Leonard's living room is often also used as a place of science (in a way) the setting of it has to have a more "professional" look sometimes which is usually done by either putting the desks with their computers into the view of the camera or simply by scattering open books, notebooks, yellow notepads and pencils onto the coffee table. It gives the whole scenery a "geniuses at work" kind of look.

As Saltzberg and Kaplan have pointed out (Pain 2013; “The Brain behind TV’s The Big Bang Theory” 2013), to show the work of a scientist who is hunched over his computer for most parts of his day would not bring a lot of entertainment to the audience, but it takes only a few indicators or tools (like pictures, books, telescopes etc.) to create the illusion of them being at work. It appears as though having the right requisites is the key to not just making the whole series look scientific, but also illustrating the atmosphere and wordlessly telling a story. It is interesting that all it takes to give the impression that someone is doing serious work is to put them behind a laptop and surround them with books, notes and make them simultaneously look at the screen and write into a notebook.

As the boundaries between the private and the professional setting are not concretely drawn within this sitcom (see chapter 9) it is important to have elements (such as the whiteboard) that help to transform the place into what it is meant to be, without using up space, time or dialogue. The arrangement of the whiteboards around Sheldon, who sits in front of books with a pen in hand, is an indicator that he is working on something. The situation reflects a scientific approach solely based on visual cues, which is an advantage of this kind of genre; as it needs to be visually self-explanatory a lot can be said with frames, props and backdrops.

## 6.2 Reading in between the lines

### 6.2.1 Cyber- chondria

Cyberchondriacs are people who search the internet excessively to relate the symptoms they think they are showing to a disease. According to the short segment in scene three, Sheldon most is likely to be a cyberchondriac (as he searched his symptoms online and now fears for his life). This situation in one way or another appears in other TV shows and sitcoms as well, yet the context and background makes the situation a bit more curious: Sheldon is a distinguished scientist, he should know better. It is interesting that Sheldon approaches diseases the same way as he approaches everything else, by collecting data, yet he seems to be unable to process the information and make sense of it. Throughout this whole series, Sheldon is put in uncomfortable situations that he analyses and handles with mathematics, logic and common sense, yet he is overwhelmed with a list of possible illnesses the internet provides him with for having abdominal pain. It is the first situation that shows Sheldon as vulnerable and not in control. There is nothing calculable in the situation and Sheldon is helpless. There certainly are a lot of possibilities to interpret this incident; the one sticking out is that even a brilliant scientist is not infallible. You may be an expert in one field/thing but that does not imply you are an expert in others too.

This claim is manifested in the fact that, if Penny would have a similar reaction to having a stomach-ache she certainly would not react that way. The characters representing the lay people (the non-

scientists in this case) would normally be confident enough to not be insecure by information found online. Yet, Sheldon's behaviour is what makes the whole situation funny; it is relatable (people do research their symptoms online) yet the situation is slightly exaggerated.

As "The Big Bang Theory" is a sitcom, the issue of being a cyberchondriac is covered as an occasion that is funny. The fact that the person made fun of is the genius researcher adds to the joke and stresses a point that is not often stressed in the portrayal and description of scientists on television: they are human too; non-experts in disciplines other than their own, insecure and afraid of death by abdominal pain. In a sitcom, they can be portrayed this way. The humanity of scientists in other formats is less likely to be based around issues that make them look vulnerable and a bit ridiculous.

### 6.2.2 Technology

Another issue that is quite often covered in various episodes throughout all series of "The Big Bang Theory" is technological failure which can have different faces: from the wrong handling of a technology, to the wrong implementation of it or the failure of a technology to work in predicted ways.

In the episode used as an example in Chapter 5 it takes quite a while to discover the downsides to having a mobile virtual presence device. Sheldon seems to have thought about everything, it can even be reassembled so that Leonard can put it in his car and take it to work. Only in the eighth scene a downfall can be seen in the technology, as Sheldon has not provided it with arms and therefore is not able to open his office door by himself. The safety that Sheldon won by replacing himself with a robot on wheels is traded in by his independence as from afar he is dependent on his friends to open doors for him.

This presents an important and relatable problem: the technology used in order to gain freedom restricts one's independence to certain degrees. There are positive as well as negative aspects to it and it is a question of negotiation which side prevails. In this case the fact that the mobile virtual presence device does not have arms, in Sheldon's eyes, is a burden but it is outweighed by the possibility to remain in a "save environment" yet being able to participate in life outside of his bedroom.

It is visible throughout the whole episode that this consideration process is not linear. In the short period of time the audience follows Sheldon efforts to elongate his life he has an upset stomach, hurts his ankle, build his own robot, nearly causes a car crash without being physically present and in a split second decides to forget about his mobile virtual presence just to hurt himself once again. It is an overdone picture of dramatic events within a short time span, but it reflects on situations and the resulting decision making processes. It is an abstract problem/issue, yet, it is transferable to

situations more accessible for the audience. The average viewer might not engage in the question of replacing oneself with a mobile virtual presence device, but they might have thought about engaging with people via devices that represent them in certain situations (e.g. video conferences) or they might as well have thought about elongating their lives and certain devices that promise success in this regard (e.g. apps, heart rate meters, etc.). Just like Sheldon, most people face problems with these kinds of technologies at some point, it is a somewhat familiar yet exaggerated situation which potentially makes people laugh and reflect at the same time.

### 6.2.3 The mobile virtual presence device: a metaphor?

Superficially the mobile virtual presence device is not necessarily a metaphor; it is a technical representation of a main character, embedded in the plot as a means to show that in fear of one's life, people go as far as staying at home while participating in their "daily life" via a camera, a screen and a computer. The mobile virtual presence device is a machine that allows Sheldon to be in a place without physically being there.

But looking at the mobile virtual presence device from outside the episode, it appears as though it represents more than just one specific character. The technology appears real/ feasible and the viewer can potentially be convinced that this is a development that will be a reality soon. But in this very moment it is an indicator/ placeholder for future developments; it represents a possible future.

It can be a metaphor for the relationship people have with technologies in general. Technology is used as a means to improve one's life, yet at the same time it estranges people. Sheldon experiences his own life only second hand, as he participates in social interaction via a machine; a situation that can possibly be translated into the situation nowadays where people experience moments while looking through their camera phones (for example when someone uses a camera phone to record a situation instead of actively participating in the same situation). The mobile phone builds a barrier that allows to witness the situation but not to actively participate in it. Just like the mobile virtual presence device would.

The mobile virtual presence device illustrates and visualizes technology and its applications in a way that appears very real and tangible without explaining it, yet it appears easily understandable. It also shows how easily technologies can be embedded in situations and can intuitively be made sense off.

## 6.3 Embedding science into a sitcom

### 6.3.1 Sheldon's attachment to technology

It might become clearer at this point that the character of Sheldon first and foremost has a special position among the main characters in the show. Also, he has the most distinct relationship with science and technology.

His obsession/passion/attachment to technology is especially visible in the scene where he wants to go jogging with Penny. While he has never been jogging he brings a lot of equipment along, while Penny, who is running on a regular basis, shows up to their appointment empty handed. Sheldon is not only fonder of technology in general, he also seems to be more interested in using it for improvement: the elongation of his own life in the case of the mobile virtual presence device and the fact that he has a heart rate monitor, a pedometer and telematics in his shoes in order to monitor and observe his running activity show that he would be able to secure information for further analysis in the future.

Sheldon's attachment to technology is a way of reinforcing his status as being socially awkward. He brings along technical devices that doctors could use to do a stress echocardiography for a jog with Penny. His efforts seem out of proportion which makes him look curious/ interesting. It is not only Sheldon though. Howard is relying on technology as well. While Sheldon uses it to control situations, Howard uses it to compensate his character's weaknesses while Raj and Leonard are using different technological gadgets to pass their time.

The sitcom in this regard allows for a variety of ways to engage with technology in an extent that other formats might not be able to. In a small time frame the audience can be presented with different opinions about science and technology as well as with different ways of engaging with it. There is a variety in the representation as well as in the perception of the characters involved which reflects the broad spectrum that these issues are faced with "in real life" as well.

Sheldon's attachment to technology also is a way of integrating technology into the storyline without having to use a lot of back story. The recurring viewers are familiar with his behaviour and even the new viewer can understand that Sheldon has a close relationship with science and technology purely based on his actions and interaction with other characters (or more precisely by the lack of astonishment that the other characters show in regard to Sheldon's behaviour). His attachment offers a lot of opportunities for storytelling because wherever there is science and technology there are potential downfalls, traps and failure which can make up a funny story to tell. This kills two birds with one stone: there is a story to tell and it involves issues of science and technology.

### 6.3.2 Jokes, humor, laughter

From a personal point of view I find "The Big Bang Theory" very amusing because of the characters. They are often thrown into situations that seem somewhat familiar, yet they have their very own way of handling them.

Dissecting the episode "The Cruciferous Vegetable Amplification" it becomes clear, that the "meta" joke in this specific episode is the fact that one of the main characters replaces himself with a robot which, in the scene it is revealed, causes a lot of laughter. It's the absurdity in the situation as well as the "taking a thought too far" approach; the reaction of the characters involved as well as the enforced laughter of the laugh track that make the audience laugh about the monitor on wheels "dressed" in a T-shirt, spin into the scenery.

- ***Sit(uational) Com(edy)***

The main characteristic of a sitcom is that it is fictional, the scenarios are scripted and humor emerging from those situations is intended; the whole storyline has to be entertaining and while the series is always supposed to be as "accurate" as possible, in the end it is still the result of the imagination of writers, producers and actors.

While I have regularly been watching sitcoms I never paid a lot of attention to the details of what makes things funny, let alone how jokes were embedded and written into episodes. My impression was that writing jokes was about thinking of lines in the manner of "a man walks into a bar..." or blonde jokes or other jokes of that kind. But a joke can be anything that makes the audience laugh or at least grin. It turned out to be rather difficult to find those kinds of "scientist" jokes embedded in conversations in "The Big Bang Theory". Humour is a lot more than a joke. A joke has to be humorous, but humour is not dependent on a joke.

As the main source of humor is the situation in this specific genre the amount of “proper” jokes is neither very high nor specifically important. In the example episode a lot of the laughter arose out of Sheldon’s way of talking, his way of dealing with things and his interaction with the other characters. It also appears to be very funny to hear someone falling down the stairs. It is situational comedy and comedy in this regard which showcases personal reflections as well as oddities and abnormalities of life that people can relate to (Sturges 2010). These situations can be regarded as humorous because they show that nothing earthly and human is ever perfect (Ruch and Carrell 1998). When the audience laughs at Sheldon for being upset that he won’t be able to have a dogapus, it is a way of understanding human behavior (Sturges 2010) (because we would all be upset by not being able to have a puppy, and Sheldon is as upset as a little child; it is funny to see his reaction) and at the same

time it shows that humor is something inherently cultural (Plester and Sayers 2007; Wycoff 1999; Mulkay, Clark, and Pinch 1993).

- ***The typical scientist joke***

As already pointed out the "typical scientist joke" is one that incorporates phrases like "a scientist walks into…" or something like "what's the difference between this and that kind of scientist" etc.. It turns out to be really difficult to find any of those jokes throughout all the four seasons I watched. The one I want to present right now is told by Penny who, by telling the joke wants to proof that she is part of the guys group and understands them better than their new neighbor Alesha ("The dead hooker juxtaposition", Season 2 Episode 19).

**PENNY**
Hey guys, Guys! You will really appreciate this; I read the best science joke on the internet. Alesha, you won't get it, but it is right up their alley. Anyway…so this physicist goes into an ice cream parlor every week and orders an ice cream sundae for himself and then offers one to the empty stool sitting next to him. This goes on for a while until the owner finally asks him what he is doing. The man says "Well, I am a physicist and quantum mechanics teaches us that it is possible for the matter above this stool to spontaneously turn into a beautiful women who might accept my offer and fall in love with me." The owner than says "Well, lots of single beautiful women come in her everyday why you don't you buy an ice cream for one of them and they might fall in love with you?" And the physicist says "Yeah but what are the odds of that happening?"

("The dead hooker juxtaposition", Season 2 Episode 19)

The point with science jokes is that in order to tell and understand them you need to have "*sufficient scientific knowledge to get the science right but also sufficient cultural knowledge to reproduce the text in the first place"*(Bucholtz et al. 2011). While Penny certainly does not lack the cultural knowledge of how to reproduce a joke she had read online (she is an actress nonetheless) she does lack the sufficient scientific knowledge to see that the last line of the joke for a scientist comes around rather as an insult than a well delivered punch line.

The purpose of having this joke placed at this point of the story line is to show that it is quite difficult for "others" to fit into a group as well as to understand them and their humor. It is not to say that scientists do not have a sense of humor and are easily offended but as it turns out a "scientist joke" is not necessarily one to flatter their character. What it also shows very nicely is how being able to understand a joke is a means of validation and inclusion (Beavers 2011), as Penny thinks she understood the joke she validates herself as a member of the group. It shows the inclusion and exclusion that can be done with a joke; similar to the power of language being able to tell and understand jokes is often dependent on knowledge that is assumed and shared by a specific group of people. It appears to me as though "scientist jokes" therefore are always used on the verge of lay

people and scientists negotiating their relationship; to share a joke in this way is to share a common understanding of what they think is funny.

- ***Laughing with science***

As already pointed out, one of the main reasons "The Big Bang Theory" may appear amusing is because it deals with a group of people that are both very different and quite familiar at the same time. They have occupations that most viewers probably are unfamiliar with, they use references and vocabulary that may be uncommon and they pass their time with activities that are unpopular or unknown as well. But at the same time, they are human beings like everybody else. The viewer can laugh because the way Sheldon tries to figure out when he is going to die seems ridiculous but the viewer can also laugh about the fact that Leonard is helpless against his bossy roommate.
For the purpose of this thesis, it is more interesting to focus on the "weird things" that appear to be funny though, because those seem to be linked to science, technology or the intrinsic behavior of a scientist. The question that has to be raised is whether or not the humorous aspect of those situations is about laughing or ridiculing.

According to one of the STS papers I read on the humor in science or more specifically scientific jokes (Mulkay and Gilbert 1982) there is one basic "rule of thumb" to when something might trigger humor:

> *"The humorous incongruity is created either by displacing a form of scientific discourse into an everyday situation, or by introducing a commonplace lay conception into a research context."* (Mulkay and Gilbert 1982)

As an example for this kind of jokes/humor I would like to have another look into the episode "The cruciferous vegetable amplification", because I think that there are some scenes that show how the combination of scientific and lay knowledge does indeed create laughter. I may add that I refer to the moments in the scenes where laughter is audible from the laugh track/audience (it remains unclear to whether the laugh track dubs or substitutes the audience laughter).

For example in the very first scene Leonard looks over the diagrams Sheldon has drawn on the various white boards and notices the abbreviation "KBB", which he is unfamiliar with. From the previous part of the conversation it is obvious that KBB must be some kind of disease but unlike HIV, HPV or OCD, it is not one Leonard can easily match to anything. Sheldon gives a short and conclusive answer:" Killed by badger."
In this very moment lay and scientific knowledge come together in a way that makes Sheldon look quite ridiculous. Everyone might have put together information on deceased relatives in order to see if there are hereditary diseases in the family but it is unlikely that anyone would go as far as to gather

information so precisely that one finds abbreviations for statistically irrelevant information as the possibility of being killed by a badger. So Sheldon's sheer paranoia to leave important information out and the fact that he marks everything so neatly that he can put it in an equation creates laughter in this case.

In the whole first scene there is laughter after practically every interaction between Sheldon and Leonard. This, like Mulkay and Gilbert would say, is because of the "juxtaposition of lay and scientific interpretative repertoires"(Mulkay and Gilbert 1982); on the one hand there is Leonard who tries to figure out what is going on in his living room, which at this point is stuffed with scientific equations rather than a coffee table and a television set, and then there is Sheldon, who is determined to find a mathematical sound solution to the mystery of his estimated time of death. The viewer can see from the way they are behaving, that they both have mathematical understanding, but it is also obvious that in this scene Sheldon is the "crazy "scientist while Leonard is disturbed in his morning routine by the crazy person scribbling on a white board in the middle of their living room. The situation alone is already absurd enough to be considered funny, so the way they talk with each other is kind of a humorous bonus.

In the first scene of "The Cruciferous Vegetable Amplification" it becomes apparent that the viewer is laughing with the characters and not at them. Even though Sheldon behaved ridiculous, the laughter does not appear in instances that would indicate that he is laughed at, he receives the kind of "What is going on?" laughter that goes hand in hand with what Leonard must be thinking in the exact situation. Maybe the audience does laugh at Sheldon, but it is not to ridicule him, it is because the situation is odd. On the other hand the audience clearly laughs with Leonard, mainly because he acts in the way most viewers probably feel they would as well.

The way the laugh track carries along the jokes and funny occurrences seems as though the main factor to create humor in this series is human behavior in general. The oddities and obstacles that can make life funny, as can the way your friends behave and the fact that you cannot stand up to your bossy friend. Science and technology and the like seem to be an asset to produce further weirdness but from the very core, the situations might be funny if they were to be embedded in another setting and social group.

- ***Humor as disguise***

Yet, it also has to be paid attention to the fact that humor can be a very powerful tool that indicates more than just a funny occurrence. Humor can help dealing with a problem in interaction (Mulkay, Clark, and Pinch 1993), it can be used as a tool to strategically misrepresent situations and conversations (Mulkay, Clark, and Pinch 1993) and can exclude people that do not understand certain cultural dimensions that are in place (Wycoff 1999). Sometimes it is possible to say things

that would otherwise be inappropriate or forbidden simply by putting them in a joke (Mulkay, Clark, and Pinch 1993). There is a power in laughter as it often can be a disguise for something that is more serious than it appears to be on the surface. Criticism as well as controversies can be communicated in a positive light, when they are embedded in something humoristic.

As the science consultant of the show, David Saltzberg, points out in on interview, in one episode he was doing a graph for one of the background whiteboards which had a bit of a controversial content of which he informed the writers, who then included a line in the script that served as a punch line ("The Brain behind TV's The Big Bang Theory" 2013) which absorbs the uncertainty and delivers laughter instead. Even though the format of the sitcom "promotes" happiness, it is important to keep in mind that sometimes there might be more serious and important issues underneath a layer of irony and comedic elements; problems that are caused by the lack of social skills, social anxiety, funding for projects, fear of death etc., to name just a few. They are all part of the stories told within the series and are part of what the audience laughs about. In this specific case they work as the fuel for humor because they draw on people's emotions. As we can relate to them we are able to laugh, which can also be a way of handling those emotions in a positive way.

# 7. Places of science - Can a television series provide space for communication?

As already mentioned, place is an important entity within “The Big Bang Theory”, as the setting is part of what makes it stand among other series and more interesting to watch. The settings are what makes one sitcom distinguishable from another and adds to its visual image. By definition, there usually are only a limited number of recognizable sets shown within the majority of the sitcom though.

Those sets have to be recognisable as a specific place within the sitcom (e.g. Penny’s apartment), but they also have to be identifiable as the kind of scenery they are representing (Howard’s workshop has to look like a workshop). Given that the series revolves around scientists, a large part of the plot is set within the space of places that represent science to the audience, like different laboratories stacked with a variation of equipment. But as the audience follows “ordinary days” in the life of scientists as well, they are also shown in the realm of their homes, in their offices/ laboratories/workshops and in the cafeteria during lunch break.

Those sets represent “real” places; places that look real and transport the message even to people that have never seen the workspace of scientists; to make those places look tangible and real. They still apply to the three ground rules that Gieryn sets for places: geographical location, material form and investment with meaning and value (Gieryn 2000). Apart from the fact that the locations are fictional, they are places that can be found on a (fictional) map with clear boundaries, they have a physicality which means they can be entered, doors can be closed and the machines inside the rooms can make noises and according to the state of the place, they have different functions. They provide a location that determines the behaviour of the characters and promotes the plot in a way that other places might not. There is something about these places apart from their looks that makes them special for the series in general and the plot in specific, which only that specific place can provide (e.g. that Sheldon grows his own bacteria cultures might look a bit odd when he does it in his office, but it is absurd when done in his kitchen).

In general, there are two different kinds of places presented in “The Big Bang Theory: working- and private spaces. Working spaces include all those places that are located within the university and therefore reflect professional working spaces, while private spaces account for those places that originally are used as private living spaces. As will be visible later on, the boundaries between professional and private spaces can be blurred in terms of their usage as well as their physical setting as for example one important setting is the cafeteria, which is part of the university. Yet is used as a place of social gathering which is not related to work per se. In order to point this aspect out, I will start by introducing the characteristics of the working spaces first.

## 7.1. Working Spaces

The working space in “The Big Bang Theory” on a big scale is the university the four main characters are set to work in. The places I will discuss in the following paragraphs are all locations within the university. Most of them are places that have a scientific look and “function” as they feature technology or science in one way or another but there is one specific place (the cafeteria) that hosts professional conversation without being a place of science.

### 7.1.1 The laboratory

As the only experimental physicist, Leonard is the only character who seems to have his own laboratory; a fact that is never clearly stated, yet whenever this set is featured, he is the sole person working there. In comparison to Raj and Sheldon he is never seen sitting behind a computer of a conventional office (see Figure 8).


Figure 8 Screenshot Leonards Laboratory (The Gorilla Experiment, 2009 © Warner Bros. Entertainment Inc.)

It is unclear what exactly Leonard does and for the average viewer the specificities of his work are probably nondescript. As can be seen in Figure 8, on his workbench there are mirrors, a tube etc. but the objects themselves, at least to viewers without specific education, do not disclose the nature of his work. In the accompanying dialog Leonard explains the set up and points out that it is a set up for an experiment with lasers. This still does not answer the question of Leonard’s exact occupation but it illustrates what the objects on the table are used for. While a glance into the place might reveal its purpose (as indicated by the objects in front and the machines in the back of the screen) the real use of it is only revealed when the visual is accompanied by a textual explanation.

### 7.1.2 The office

In contrast to the laboratory, there are the offices of Sheldon and Raj. Raj is often placed in various specific laboratories (for example in a room with a telescope) yet he most often appears in the context of an office.

Figure 9 Screenshot Sheldons office (The Griffin Equivalency, 2008 © Warner Bros. Entertainment Inc.)

The office most frequently shown is Sheldon's. He occupies an office that is neither notably run down nor neat and, apart from the obvious white board, at first glance it could belong to an accountant just as much as to a scientist; it contains a few book shelves filled with books, a diploma hanging on the wall, as well as a computer and a desk (see Figure 9). As the series continues, Sheldon has to share his office with Raj for a while, which creates tension because the sitting order is perceived to reflect a hierarchy which neither of the two approves off.

Figure 10 Screenshot Rajeshs office (The Griffin Equivalency ,2008 ©Warner Bros. Entertainment Inc.)

In Raj's case pinning down his working environment is more difficult as he is the only character featured in a lot of different settings. He has his own office but is often shown in various "laboratories" handling big machines, which (as he is an astrophysicist) may be identified as telescopes or something alike (see Figure 10). Before he is forced to move into Sheldon's office, his own office looks more like that of a scientist because apart from the obligatory heavily book shelves it also features models of space ships, rockets and a laser sword (the later not being an indicator for science but for the "nerdiness" the scientists in this series are connected to (see Chapter 8)).

In a paradox way those two offices do not need an explanation to what kind of work is done in those places, even though they are "just" offices. The little indicators, as for example the white boards with equations, in Sheldon's office are visual cues to at least the fact that mathematics may be a main issue of the characters occupation.

### 7.1.3 Howard's Workshop

As Howard is an engineer his working space is less a place of science itself, but rather a place of technology. In comparison to his friends Howard has neither his own laboratory nor an office, instead he shares what looks like a "technological workshop" with other people. I like to use the word workshop instead of laboratory, because as it is often pointed out that Howard's job is to make things work and less to experiment. In terms of setting, his work bench is located in the front and there are usually colleagues working on other benches in the background.

Like in Leonard's laboratory, there is what can be described as "heavy machinery" as well as little machines, wires, screws, tools and measuring instruments scattered around giving it an "authentic" look (see Figure 8 and Figure 11).


Figure 11 Screenshot Howards workshop (The Jerusalem Duality, 2008 © Warner Bros. Entertainment Inc.)

What all those places have in common is that they show what can be assumed to be conventional working spaces. They have an accurate look even though in some cases it might be argued that some "real life" safety restrictions/codes of conduct are not accomplished. As can be seen in Figure 11, there is food on Howards work bench, which would be uncommon in real laboratories due to safety regulations.

The fact that those offices, laboratories and workshops have a genuine look is certainly due to the details that are featured on the various sets and tailored to their demands. For example, there are various safety alert signs, the mirrors and lenses and laser on Leonard's work bench, the arrangement of books and papers in the offices, the white boards as well as the people in the background hunched over their work benches, the big machines as well as the big tool box in Howard's workshop. Those are all little things that can be connected to science and engineering and reinforce the imaginations of the look of a laboratory.

What is interesting is that the characters are mostly set up at their own space. With the exception of Sheldon and Raj, who share the office, each occupation has its own location. Leonard has a laboratory, Howard a workshop, Sheldon and Raj have offices and Bernadette and Amy work in laboratories that again have a different look than the laboratory Leonard works in. There is a lot of variety in those places, even though they embody the same principle, being a "place of science". As the sitcom recurrently uses the same places the viewer's get acquainted to them visually. The setting

does not affect the plot though. The equipment they are potentially handling in various scenes would only be a reference in the dialogues that can revolve around something completely unrelated to what they are doing.

Even though the reference to science and technology are in the visual focus in these scenes they are never in the focus of the story. They don't need much explanation; they make up the background and reinforce the characters as working scientists.

## 7.2 The cafeteria

The one room within the university that is frequently featured is the cafeteria, where the main characters gather around one table. It is the only place within the university all four of them are deliberately shown together. They don't always talk about professional problems but occasionally one would mention achievements or failures related to their professional work which then further can be an issue for discussion. The cafeteria is the most social place in the whole setting, as it often features other scientists passing by interacting with the main characters. Small talk would include personal as well as professional questions; much like lunch break conversations would commence and proceed in "real life".

The cafeteria is a place where the main characters also engage in conversations with other scientists. In fact it may be the only place where they do. Much like in real life, it is a place where people inevitably meet each other. They discuss work along with personal issues while passing through with coffee, drinks or lunch while one group is sitting and another person is casually standing next to them. It is a place where everyone comes together. The conversations between the characters are quite personal even when other characters (like the head of the department) are involved. Much like in "real life" the cafeteria is a place that induces bonding rather than knowledge transfer (Davenport and Bruce 2002). It is a place between work and home, a site of community and sociability (Warner, Talbot, and Bennison 2013) which provides a casual atmosphere that favors "bonding" moments amongst the characters. There is a certain playfulness to the place and as all the people within the university share the same place to eat their lunch, there also is a sense of joy and acceptance (Warner, Talbot, and Bennison 2013).

Within "The Big Bang Theory" the cafeteria appears to be a place of community and social interaction first and foremost. There is not a lot of talk about work and if there is it is limited to a "one sentence conversation". But there certainly is a link between the processional work setting (the university) and their private homes, as it is located in their professional environment, yet it provides a "homelike" atmosphere.

## 7.3 Living spaces

An apartment is not the first place you think of, when experiments are mentioned. Indeed, it actually is the last place one would expect experiments to take place; at least not experiments that have a scientific value, experiments done by "proper" scientists or experiments that are supposed to be legitimate. When thinking about people that conduct experiments in their living rooms or basements or the like, there is a somewhat negative connotation as if there is something dodgy or illegal about the experiments carried out. Scientists working in secrecy at home appear to be suspicious, as if they have something to hide, they must have isolated themselves because they are obsessed or have questionable goals and methods (Weingart, Muhl, and Pansegrau 2003). It hasn't always been like that though. In the 17th century experiments, were conducted and performed outside of universities, in a variety of venues - from coffeehouses to apothecary's to the private residences of scientists (Shapin 1988). This was mainly for practical reasons as the laboratory as such did not exist yet and in order for experiments to be considered as producing genuine knowledge, they had to be witnessed by an audience (Shapin 1988). As long as there was an opportunity for people to come and see the experiments, they were seen as producing legitimate knowledge, regardless of the specific place they originated from. The public had to be involved in one way or another because even in the 17th century, a scientist working all by himself all the time appeared to be a bit suspicious (Shapin 1988).

Looking into the living spaces of the characters in "The Big Bang Theory" and at what they are doing when they "conduct" experiments at home, it becomes apparent that those vary significantly from the kind of work they do within the confined space of the university.

Part of what makes it interesting to do science at home is that- as a space- it provides comfort and lacks laws and regulations which have to be fulfilled at the work place (therefore it is not a problem to recreate the space toilet Howard built for the NASA in Sheldon and Leonard's living room ("The Classified Material Turbulence", Season 2 Episode 22)). In "The Big Bang Theory" experimenting at home usually involves building something which, by the look of it, resembles crafting as it would require handicraft and the participants sitting in between piles of material they need to fix and create. The specific situation involving the space toilet actually does not really count as being an experiment, yet it serves as an illustration of the argument that some activities have to be done in the neutral surrounding of one's own home (neither the NASA nor the university would have been pleased to know that their employees are working on classified projects in a living room).

But occasionally there are "real" experiments shown in living spaces too. Or at least they legitimately look like being serious and the explanations accompanying them sound plausible and valid too. They can either have a large scale or would be of the kind of experiments that viewers might have witnessed in one way or another before.

There is, for example, a scene ("The Lunar Excitation" Season 3 Episode 23) where Leonard, Sheldon, Howard and Raj conduct an experiment on the rooftop of the apartment building in which they attempt to shoot a laser beam to the moon. They are joined by Penny and her boyfriend Zack, who are unsure what to expect of this demonstration, as neither of them has ever heard about or seen anything similar; Zack, for example, has the preconception that something is going to blow up. The experiment is set up on the rooftop of the apartment building Leonard, Sheldon and Penny live in and contains various computers, a large laser and a detector and miscellaneous equipment which immediately brings up the question of how they brought all those things up the rooftop. Yet as this is a fictional series that question will remain unanswered. It still shows another advantage of doing experiments at home: there are no restrictions. If you want to shoot laser beams off your rooftop, you just bring all the equipment upstairs and do so, but if you do the same thing on the university's rooftop, there certainly will be strict consequences.

What happens next in the scene can be seen as an illustration of one of the downsides of doing science at home with lay witnesses: they do not appreciate what they have just witnessed.

Everyone stares at a computer screen and waits for something to happen:

> **HOWARD**
> There it is. There's the spike!
>
> **LEONARD**
> 2.5 seconds for the light to return, that's the moon! We hit the moon!
>
> [Everyone seems excited except Zack]
>
> **ZACK**
> That's your big experiment? All to have a line on the screen?
>
> The Lunar Excitation Season 3 Episode 23

An unimpressed audience indicates that something must have gone wrong, because otherwise they would have noticed the magic that they have been shown, or would they? Bearing in mind that in the 17th century, witnesses were a part of knowledge making, you wonder whether this demonstration would have been described as successful, because even though the experiment might have been, the witnesses might not see it that way.

If the same experiment would indeed be done in the realm of a university, it would have looked a bit different, maybe not so much in the way it is set up, but in how the reaction would have been. Mainly because there would not have been lay people in attendance, therefore the joy of having the right results might have been more enthusiastic, emphasizing how differently success is defined by scientists and lay people (a spike on a screen may turn a scientist's paradigm around, while it may

remain “just a spike” for a lay person). But by having someone pointing out that the outcome is essentially a little spike on a screen, the success of the experiment seems to be belittled.

This was one of the “big” experiments that are conducted during the various seasons within Leonard and Sheldon’s apartment (they have the biggest apartment so the experiments are always conducted there) who usually feature huge set ups, heavy machinery and a lot of knowledge. Contrasting those, there are also “average” experiments that distinguish themselves by being recognizable and reproducible.

An example for the later kind of experiment is shown in the episode “The Barbarian Sublimation” (Season 2 Episode3). Leonard, Sheldon, Raj and Howard are gathered around a speaker which lies on the coffee table and is wrapped in a plastic foil with something liquid looking on top. When Howard turns on the music, the liquid starts “dancing”. As Penny enters the situation, Howard turns the music off, the liquid remains still on the speaker and Howard explains the phenomenon of the dancing corn starch and water mixture.

This is the kind of experiment that assumingly can be pictured within a living room setting without seeming to be out of place or dangerous. It is not one that would be conducted in order to do research or give any scientific information. It is not a scientific experiment executed by a university professor in a research lab, but it might serve as an illustration for certain phenomena and characteristics of certain liquids, so it might be shown in lectures or the like. This kind of experiment could also be enacted in chemistry class in high school, because it is rather easy to reenact. Also, it serves as the kind of experiment that people would be able to recreate at home for pure entertainment.

And then there is what I would call “the domestic experiment”, which basically means that one of the characters (mostly Sheldon) is conducting a scientific experiment using domestic items and/or uses domestic issues as hypothesis.
An example for this can be seen in the episode “The Luminous Fish Effect” (Season 1, Episode 4) when Sheldon is in the kitchen and appears to be frying eggs.

**LEONARD**
You’re making eggs for breakfast?

**SHELDON**
This isn’t breakfast, this is an experiment.

**LEONARD**
Ah, ‘cause it looks a lot like breakfast.

**SHELDON**
I finally have time to test my hypothesis about the separation of the water molecules from the egg proteins and its impacts vis-à-vis taste

**LEONARD**
Looks yummy. I look forward to your work with bacon.

The domestic experiment is mostly conducted by Sheldon and features everyday objects and procedures with which Sheldon tries to increase his life quality (see Chapter 5). This shows that science and experiments are not just limited to the confined spaces of a university but that they can be done in private settings like apartments as well.

It is interesting to see that the university as a set within “The Big Bang Theory” is never really used to show experiments. Things that are done there are rarely explained and appear to be more of an additional occupation that is subordinate to the plot while the experiments that are done at home are usually a big part of the plot. Shown in this setting, they always are also part of a joke. This mediates that experiments, when done in a less professional and more casual setting, can be funny or humorous. At the university they are part of “work”, while in Leonard and Sheldon’s living room they are a way to pass the time.

# 8. Analyzing the human actor

> *"The scientist is a man who wears a white coat and works in a laboratory. He is elderly or middle aged and wears glasses.[…]He is surrounded by equipment: test tubes, bunsen burners, flasks and bottles, a jungle gym of blown glass tubes and weird machines with dials. The sparkling white laboratory is full of sounds: the bubbling of liquids in test tubes and flasks, the squeaks and squeals of laboratory animals, the muttering voice of the scientist."* (Mead and Métraux 1957)

This quote by Mead and Métraux is from a survey they did on the perceptions of scientists in the eyes of High School students. Even though it was published in 1957, some of the main points still resonate with the public image of scientists today: a middle aged white male in a white lab coat surrounded by different sized glass bottles and dishes filled with curious things. It is still a "go-to" image when it comes to portraying science. The characters in "The Big Bang Theory" on the other hand do not look like scientists as depicted in this image. Most of them are white, but they do not wear lab coats nor do they work with chemicals, petri dishes or the like. They represent a different kind of scientist, a "nerdy" one; they are no longer bound to specific clothing and a laboratory.

## 8.1 The main stereotypes

When looking at "The Big Bang Theory", the first striking thing in terms of stereotyping is, that they are not the typical white, middle aged male scientists wearing lab coats, yet it is apparent within the first few minutes of watching the series, that they are scientists never the less. So even though there is a very visual idea of how a scientist has to look, there also must be a recognisable narrative of how the character has to behave that allows for them to be identified so quickly.

The characters in "The Big Bang Theory" are distinguishable from other scientists on television as well as from movies because they are physicists (with a focus on astrophysics, experimental physics and theoretical physics), which means they don't necessarily handle chemicals, but lasers or telescopes and are not obliged to wear lab coats. The only thing Howard, Leonard, Sheldon and Raj have in common with those "other" scientists, at least visually, are the bad haircuts and the glasses. They are portrayed as being very intelligent and successful scientists; they lack narcissistic tendencies (except Sheldon) and their genius is more to be assumed then exaggeratedly shown. They don't really brag about accomplishments but, if they do, they are set straight by the others. It is kind of a running gag to not pay attention to the big achievements, for example when Howard becomes an astronaut and no one cares.

## 8.2 Special characteristics

One of the features of a sitcom is that it has a small main cast and a handful of recurring characters. All of those characters are important for the overall perception and image of the specific sitcom but

the individual characters make for the interesting stories. The characters have to be recognizable, captivating and interesting. And each of the characters has a specific role in the network of interaction and storytelling.

**LEONARD**
Why do I always have to carry the heavy stuff?

**SHELDON**
Well, that's very simple. In our ragtag band of scientists with nothing to lose I'm the smart one. Wolowitz is the funny one. Koothrappali is the lovable foreigner who struggles to understand our ways and fails. That leaves you, by default, as the muscle.

**LEONARD**
One more floor and I'd be the pulled muscle.

("The precious Fragmentation" Season 3 Episode 17)

The characters are the centrepiece of the sitcom and therefore are created with great attention and detail. As Sheldon points out in the quote above, there are certain constellations that are common in a group of people, whether it is in real life or in fiction, which indicates that each of the main characters in "The Big Bang Theory" has a specific role to complement their group.
The bigger picture in this specific case is to be a functioning and relatable group of people which by their characteristic and appearance can create situational comedy; regardless of the fact that they are scientists and interact with people who are not. In the first place the characters have to be developed carefully and "work" as individuals as well as a group.

Besides the fact that they are all doing research in a technical University, the four main characters are first and foremost a group of close friends. Sheldon is the annoying friend, Leonard is the responsible, nice friend, Howard is the friend that doesn't know how to behave and Raj is the secretive friend that doesn't say much, but is very opinionated when he does speak. In contrast to other sitcoms the group portrayed in "The Big Bang Theory" is a rather functioning one where the characters are well balanced, which means they complement each other. While Sheldon is rude and opinionated, Leonard is nice and pragmatic. Raj is unable to talk to women and Howard would never miss an opportunity to approach them.

Most of the recurring characters on the show are white, young and members of the middle class, generally they represent the basic demographic of people featured in prime time television shows (Glascock 2001). Yet, this group holds a more specific place in the genre of the sitcom as they represent a profession that is rarely touched upon in conventional prime time sitcoms: scientists.

## 8.3 Creating new stereotypes

The fact that "The Big Bang Theory" is led by four main characters who are all scientists is not the only interesting point though; the characters are, at first sight, not portrayed in the "old-fashioned" way. They don't wear lab coats and there are no fuming bottles and petri dishes on their work benches, yet it is still apparent that Sheldon, Leonard, Howard and Raj are scientists. Therefore, there must be something in their appearance that immediately gives the audience at least a hint on their occupation or identity as scientists. But how is this done?

The first thing to be noticed when watching the series is that the four main male characters seem rather "unfashionable", meaning that their appearance does not appear very smart or stylish. They wear T-shirts with comic references (Sheldon and Leonard), sweater vests (Raj) or turtlenecks (Howard), all of which only indicate that the characters wearing them do not work in jobs that require dressing up in a suit and that they like to be comfortable and/or are not interested in fashion. Their occupation may become more apparent as soon as Sheldon starts talking, as this character has a way of speaking that uses scientific references and vocabulary. As soon as a discussion embarks between the characters, it becomes even more obvious that their diction is different to that in other sitcoms. Another observation that may be considered an indicator as well is that within five minutes of watching the series they can be identified as "nerds" in a broader sense.

## 8.4 Nerds

People that are considered to be nerds are not necessarily scientists, but scientists to a certain degree often are nerds. A nerd in this sense is "*someone who appears to be stupid or ridiculous especially as they wear clothes that are unfashionable and/or show too much interest in computers and science"*("Nerd" 2003). In "The Big Bang Theory" an intense interest in comic books and science fiction can certainly be added to the list of interests of the nerds portrayed. In this case it also implies that the friends have a common interest which they are passionate about that others may not share. Penny, their neighbour for example, is not interested in most of the things Leonard, Sheldon, Howard and Raj are very passionate about which is why it takes a while for them to become friends with her. As the series continues, the more acquainted the viewer gets with the series and the characters, the less their "nerdiness" stands out. In the end it is merely a strong passion. Yet it still builds a bridge into the stereotype of scientists.

Their "nerdiness" is what makes them seem weird at times and the weirdness is what connects them to the stereotype of the crazy genius. This appears to be the first "real" touching point to the "typical" scientists between the characters shown in "The Big Bang Theory" and the characters which surface in other series, movies or other pieces of science fiction. Being weird, unfashionable and obsessed with science have been attributes highly associated with scientists (Flicker 2003) and now

are connected to being a nerd as well. This may serve as a first indicator as to why Sheldon, Leonard, Howard and Raj are "easily" identifiable as scientists.

## 8.5 The mad scientist

The ratio of madness to genius, good and bad in general, depends on the genre the viewer encounters them in. In horror stories the probability to find a "good" scientist is as little as finding a really dangerous one in a comedy. Yet, there are other sets of characteristics that both of them often have in common: they are hardworking, often absentminded and/or a bit confused, they may be outsiders as well as potentially antisocial (Flicker 2004). Also, they are usually not very attractive, wearing glasses, with crazy hair and highly unfashionable clothes (Flicker 2004). They also do not care about their appearance because they have more important things to do.

There is a very fine line between madness and genius. Sometimes it is more apparent, other times the line is more difficult to negotiate. Sheldon is a good example for this; while he may not look like a trouble maker at first, he has a tendency to create drama. Yet, his way of acting out has more of a childish appeal. One of the catchphrases Sheldon uses is "I am not crazy, my mother had me tested!" which can be seen as an indicator of him not posing a threat to others. The traits that geniuses apparently hold is that they have an excessive perception as well as vast imagination (Keller 2004) which I guess can be perceived as intimidating by others. If these perceptions and imagination are paired with knowledge and dedication, madness is a catchphrase which comes to mind. Yet, it is rather difficult to point out exactly when madness becomes a problem, as for example in Sheldon's case, it could be argued that it works as a motivation to achieve something rather than to destroy something.

Interestingly, being a mad scientist is an inherently male stereotype.

In general, the female scientists are portrayed to be "good" scientists. The image of the female scientist is rather curious in itself, because there often seems to be the perception that they can either be a scientist or a woman, meaning that if they are accomplished scientists they would not look "good", while the "good looking" and charming female often would not be described or seen as an accomplished scientist (Erlemann 2004). There are a lot of different ways to portray women in movies and books though, ranging from the assistant, that is only there to help the male lead, the naïve, to the lonely heroine, that puts science before everything especially men and her looks (Flicker 2004). In the light of these general perceptions in movies, it is interesting to see how the female characters, who are scientists, are portrayed in "The Big Bang Theory". While it had taken a couple of seasons to incorporate them, the show runners managed to include two characters in "The Big Bang Theory" that appear to be equal to the male scientist's characters.

Just like the male scientists, the female characters are portrayed in a way that deviates from the way they were and still are in other formats and television shows. Nevertheless there are certain ways in which gender plays a role in "The Big Bang Theory " as there still are aspects of involving them in the storylines that is unique for the female characters.

## 8.6 The gender issue

Historically, the role of the female scientists on television has been that of a neither particularly skilled nor successful researcher. Women were either good looking or smart, they were rarely portrayed as successful and if they were, they would lack charm or good looks. While male characters could be all those things at once, female characters were either intelligent or attractive. The stereotypical portrayals were based on the thought that they would not be able to be both, accomplished scientists and good looking (Erlemann 2004) as both would require time and effort. This is also described in the six stereotypical portrayals of women in fictional film, Flicker described. They were either: the old maid, the male woman, the naïve expert, the evil plotter, the daughter/ assistant or the lonely heroine (Flicker 2003). What all of those have in common is that they are inherently sexist stereotypes which make them stand in the second rank of the scientific world for strategic marginalization (Flicker 2003).

But the female characters in this series do not fit those categories. Just like the male characters, they are not discussed by the stereotypes of scientists that have previously been employed in movies and television shows. Amy (a neurobiologist) and Bernadette (a microbiologist) are successful scientists and in all respects equal to the other scientists, even though they are first introduced to the series as the love interests of Howard and Sheldon.

But being a love interest does not make them submissive or quiet or put the guy's needs before their own. The girls are making their own rules; they are in control of their careers as well as their personal lives. It is unclear whether both of the girls are equally successful; Amy has been shown presenting a paper at a conference, while Bernadette lacks such a "moment", but she is often portrayed as having a leading role within her laboratory. Sometimes it might appear as though Bernadette is "just" a clumsy lab technician while Amy would be a more "sophisticated" scientist, but in regard to how the group of the male scientists is balanced with more and less successful scientists and different kinds of people, the differences between the girls could serve the same purposes than those of the male characters: diversity within the group.

The two female scientists are positioned to be counterparts to the male characters. Bernadette's counterpart is Howard, who is an engineer with a Master's Degree, while she is microbiologist with a PhD.

Within the frame that the characters use themselves when it comes to distinguishing between having a PhD as opposed to a Master's degree, Bernadette is more successful than Howard.
Amy's position is an interesting one, as her character is very similar to Sheldon's especially when it comes to the way they interact with other people or their thinking patterns. The only thing they really disagree on is which science is more important. The fact that they are not in the same scientific branch seems to be important though because this way Sheldon can regard Amy as an intellectual equal as he does not know enough about neurology that would allow him to judge the excellence of her work.

While the male scientists often experiment at home or get into different kinds of trouble within the space of the university, the female scientists are never seen conducting any other kinds of experiments in their homes. There are two ways of portraying Bernadette and Amy as scientists in "The Big Bang Theory": behind their lab benches or when they have casual conversations with the other characters. Showing them behind their lab benches gives the characters a very professional and scientific look, as they wear lab coats and rubbers gloves and handle petri dishes (which, as already discussed, serves the "classical" scientists stereotype). As both, Amy and Bernadette, are biologists, it is rather inevitable to portray them this way when they are in the environment of a laboratory because that is indeed a depiction of biologists in contrast to the portrayal of the physicists.

When their nature as scientists is supposed to come out in situations outside of the laboratory, the setting is usually that the female characters argue against the male characters. They are sitting in a neutral environment arguing about scientific facts or trivia. Most of those arguments end with a "win" for Amy or Bernadette and are a source of humorous conversations and jokes at the expenses of the male characters.

Neither Bernadette nor Amy are presented as being "crazy scientists", which women usually weren't anyway (Flicker 2003), but they (especially Amy) do have characteristics that can be perceived as "craziness" too. Bernadette, in contrast to her sweet and charming appearance, is portrayed as having a bad temper and Amy has an obsession with Penny, who she regards as her best friend even though it remains unclear whether that feeling is mutual. In general, they are rather lovable characters that care about the others and are less self-centered than their male counterparts.

The fact that they do not fit this overall image of the female scientist might be problematic though. While the boys can still be perceived as scientists even when they are not wearing a lab coat, it is more difficult to identify the girls as scientists when they are outside of the laboratory, as they lack

the “nerdiness” and obsessions that makes the boys identifiable as scientists. Unlike the male characters they are never shown to experiment outside of their professional spaces.

They are portrayed to be a lot more confident than the male characters and a lot more emancipated than female scientists characters have been in feature films. They bring a new perspective into the portrayal of women as scientists. As scientists they are treated equally. All the female scientists the audience encounters are portrayed to be confident and successful and respected by their peers in their professional life.

While there are always differences between male and female characters, it is nevertheless interesting to observe that at the core of the series the characters can be switched in gender and still keep its entertaining values. At least if they remain scientists. The scientist characters, regardless of their gender, have the superior part within “The Big Bang Theory”, which becomes apparent whenever lay people like Penny are included in a discussion about more “serious” issues.
As most of the humor derives from situations that are based in happenings that the majority of the audience is supposed to be familiar with, gender rarely plays a role in making jokes.

On the other hand, some of the situations Leonard, Sheldon, Howard and Raj find themselves in are quite odd and would be even odder, if a group of girls ended up in the exact same situations. If, for example, Amy replaces herself with a mobile virtual presence device, the initial reaction would probably be a lot more intensive. But at the same time the “oddness” of replacing oneself with a robot like machine is relativized by the trademarks of the scientists and theoretically a female scientist like Amy could show the same characteristics as a character like Sheldon (as in fact she is sometimes shown having them).

If gender issues arise, they are often set outside of a scientific or professional context. They mostly appear on the verge of disagreements, competition or average “gender moments” in their private lives, when the group divides into a male and female group and they then try to outdo each other or conspire against each other. There are moments where the audience finds the boys in a robot destruction derby, while the girls are sitting at home and paint their nails nevertheless these scenes are somewhat of an exception and are right within the scope of gender stereotypes which are shown in most television series. While it seems essential/ crucial to keep the gender issue out of the portrayal of the characters as scientists, it appears to be more difficult to leave the issue out of their personal lives.

The reason might be because the unfamiliar terrain of scientific work environment causes laughter in the “unknown” while the more familiar environment of personal relationships in “private places” reinforces humor that is more “domestically based” meaning that the behavior between the

characters and gender is supposed to be more “stereotypical” as in serving the idea of how a group of guys and their girlfriends looks like in the majority of homes of the viewers.

## 8.7 The “lay people”

**SHELDON**
“Yeah, I won’t say that all senior citizens who can’t master technology should be publicly flogged, but if we made an example of one or two it might give the others incentive to try harder.”

(“The Bus Pants Utilization” Season 4 Episode 12)

The preceding suggestion is given by Sheldon after Howard unsuccessfully tried to explain to his mother how to read her emails. This quote shows very nicely that there are also other imaginations at work: there is not just the portrayal of scientists, but also the portrayal of lay people.

Maybe the most obvious stereotype at work in terms of the perception of “lay people” is the character of Penny in the beginning of the first season of “The Big Bang Theory”. She is portrayed as the attractive blonde neighbor, who works as a waitress but want to be an actress, using the smart scientists next door to set up the television set. But in terms of visible, “typical” stereotypes, Penny is the only character that is bluntly laid out as ignorant and uneducated in the beginning. As the series progresses, the character of Penny progresses as well giving her and her intelligence more credit. The term “lay people” in general refers to all the other characters that are featured in “The Big Bang Theory” who are not scientists.

They are never directly referred to as lay people by the scientists in the series; there is more of a distinction between “them” and “the others”, which essentially reflects the way these characters are framed. It is only because of the distinct characters that make up the group of scientists that the other people can be referred to as “lay” people instead of just “other” characters; the distinction is easier to show as the one group is staged as a group of physicists while the main lay person is a struggling actress. On the other hand the existence of people that are shown to be less educated and interested in science reinforces the hyper-intelligent and nerd image of Sheldon, Leonard, Howard and Raj.

There are not a lot of lay people appearing on a regular basis though. There is Penny, the parents of Leonard, Sheldon Howard and Raj and Stuart, the owner of the comic book store. While “the others” are not often shown, they are often mentioned in conversations which is a way of integrating them into the storyline without having them occupy space in the restricted amount of characters that can be involved in episode plots.

The essential key to the group dynamic and the variety of the characters presented is that the group is balanced as the characters complement each other. This way there are endless opportunities to

have characters disagreeing, trying to outdo each other or having them as a group work against an outside group of scientists or lay people. They are solidified as a group by sharing the same interest and values but they are different enough to provide good storylines.

# 9. Ordering Science - Hierarchies and boundaries

“The Big Bang Theory” wants to tell the story of friendships and lives of people that are interesting because they are unlike other characters appearing in television sitcoms. They are smart yet socially awkward and weird but also lovely and loyal. As already mentioned, the stories are set in situations and dependent on the characters, which create and carry laughter. As the example episode "The Cruciferous Vegetable Amplification" showed, science and technology can be an integral part of those situations. Another way to integrate science and technology into the storylines is by embedding them in other characters. Those characters would often pose as opponents to the main characters. Another way of the integration of science and technology into the sitcom is by putting specific objects into the frame.

The following chapter presents two approaches that help to add substance as well as science to the sitcom. They feature situations in which science, technology and engineering are placed within a storyline/narrative without taking up "too much space", they are more embedded into the background but in the grand scheme of narration they help to give "The Big Bang Theory" its scientific connotation. Just like science consultants, those elements help to make fictional film more original(Kirby 2003b).

One of those approaches is the implementation of hierarchies’ in-between sciences; the other is to set boundaries. Both of these approaches aim at reinforcing the scientific and technological aspects by contrasting them to others as will be elaborated in the following chapter.

## 9.1. Hierarchies

There are social hierarchies as well as hierarchies in science to be found in “The Big Bang Theory”, yet the hierarchies in science are more interesting in the context of this thesis given that they set a tone in what the audience sees as “important” subjects and which are regarded as less popular. If one identifies with either of the sciences, there might be a preconception. There is also a certain danger of possible preconception as one science is staged as “the main science” while the others have inferior positions.

### 9.1.1 Science and its disciplines

The word science has a certain ring to it: it includes everything and anything that deals with the uncertainties of nature. Science seems to be the entity that brings clarity into those uncertainties. When looking up “science” in a dictionary, entries like this can be found:

> *“1. science is the study of the nature and behavior of natural things and the knowledge that we obtain about them 2. A science is a particular branch of science such as physics, chemistry*

> *or biology 3. A science is the study of some aspect of human behavior, for example sociology or anthropology."*("Science" 2003)

This definition once again stresses the universality of science and its close connection to nature and natural behavior of things and people. Sometimes, science is not science and there are differences between chemistry, biology and social science which bring consequences to their reception/ perception in society, which can be seen in the fact that there are three different kinds of definitions for the word science that are each based in different "kinds of science".

There are a variety of accounts of how those different disciplines can be grouped or classified, ranging from "how they manifested in the organization of the higher education system" to aspects like community, communication, values, mode of enquiry or by social grouping (Becher 1989). As is argued, the knowledge domains of those groups apparently have a big influence on the attitudes, activities and cognitive styles of the academics who represent those particular disciplines (Becher 1989). This implies that scientific disciplines and the people engaged in them have an influence on the way the different disciplines are mediated and perceived. On a superficial level this can be seen when entering for example different departments of universities in real life as well as in the different depictions of work places of the different kinds of scientists shown in "The Big Bang Theory".

"The Big Bang Theory" is based on physics yet the characters can potentially be biologists or chemists as well as far as the basic purpose of the characters goes. As pointed out beforehand, the show is about those characters that are somewhat "different"/outsiders and only "happened" to end up being scientists:

> *"[…] they decided that it would be better to make the characters scientists rather than software developers. The reason, they say, is that people could write equations on boards rather than see characters hunched over their screens, but I think they also thought that science is just intrinsically more interesting, and catches your imagination more than computer programming."* -Eric Kaplan, executive producer (Pain 2013)

The prerequisite being that the characters had to have a visual appeal in their work, they could have worked with petri dishes, pipettes and colorful liquids as well. The general stetting would possibly not change by featuring a different "main" discipline but staying with Becher, the content and the characters behavior would potentially be different, as identities and cultural attributes are often ascribed to specific disciplines (Becher 1989). As they wanted to portray a certain type of scientist, one that was weird and nerdy and not fancy, they took up physics as their main field, which apparently serves this kind of imagination of a scientist (Pain 2013). But even apart from having physicists as leading characters, science is an integral part of the series, as it provides the stage for

jokes and storylines. There is a certain hierarchy within the sciences and scientists featured within the series nevertheless.

In an attempt to rank different disciplines, Becher based them in four different domains: hard pure knowledge, soft pure knowledge, hard applied knowledge and soft applied knowledge (Becher 1989). These domains are based on how knowledge is gathered and applied which illustrates their differences in a conclusive way: the "pure" knowledge building on other "historical" knowledge while the "soft" knowledge employs more practical approaches (Becher 1989). The fact that these domains have different origins as well as different applications allows for a certain amount of comparisons and with contrast they are rated to a certain degree as well. Physics is an example for hard pure knowledge while sociology would be soft pure knowledge (Becher 1989) therefore the fact that they are not met with the same compassion by different scientists is understandable. Whenever the characters in "The Big Bang Theory" discuss their respective fields of interests they are trying to proof that their expertise is better than the other's as it uses method and theory that the others are not able to understand or use, inevitable making them the "better scientists". It is a question of standpoint nevertheless, because the different domains of knowledge all produce knowledge. In this specific case, the hard pure knowledge is set on top of the other disciplines which are subordinated to it.

### 9.1.2 Physics

Physics in the context of this series is the "ultimate" science. Among the main characters this becomes apparent in regard of Howard, who is "only" and engineer and also "only" holds a Master's degree, which makes the others, who all hold a PhD, look down on him. Even though it is clear from the context that Howard is a valuable contributor to the various projects this group of friends develops (all sorts of made up games, fabrication of various robots, etc.) when it comes to "real" scientific questions they won't necessarily consult him or give him credit for his contributions, solely because he is not a "real scientist". But it is not just the engineering department that Sheldon, Leonard and Raj look down at. Especially in interactions Sheldon has with other scientists, it becomes clear that physics in Sheldon's eyes seems to have a bigger agenda, while the other sciences can only exist at the margins of being irrelevant. It is this kind of behavior which affects this character's relationship with others.

There is a scene in which Sheldon and Amy break up after they have an argument about the relevance of theoretical physics and its presumed superiority over neurobiology ("The Zazzy Substitution" Season 4 Episode3). In another episode Sheldon claims that holding a PhD in physics entitles and enables him to be an engineer as well, as "engineering is merely the slow little brother of physics"("The Killer Robot Instability" Season 2 Episode 12) and gets into a fight with Howard as well.

In those two examples, physics is the subject set up as “the one” discipline. There are no convincing arguments made in these instances to why it would be, yet by exaggeration physics is staged as the discipline that is able to explain anything and is able to derivate any problem or issue. The aim is to make physics look like an autonomous discipline, able to explain everything. Nevertheless it has to be pointed out that this set-up is used mostly for storytelling purposes. There are no sound arguments as to why it actually is; in general any other discipline could be portrayed in this superior manner as well.

Even though there is never an articulated ranking of different disciplines of sciences in the show, there is a perceived difference between them. The fact that the main characters are (mostly) physicists, the girls are doing biology and the “arch enemies” are from the geology department may not be rooted in a legitimate attempt of rating scientific disciplines but it adds to the perception of them; reinforcing the image of those disciplines.

### 9.1.3 The ”other” disciplines

Whenever another discipline appears in “The Big Bang Theory” they are measured against physics. This is done by direct discussion of these disciplines. This “rating” is not a real means of differentiating disciplines, it is supposed to position the disciplines to people and characteristics that provide opportunities for comedic instances or jokes.

- ***Biology***

Biology is the discipline of the girls. The main female scientist characters, Amy and Bernadette, are the antagonists to the male characters which is why they cannot be physicists as well. As they do biology, a natural science, they can be regarded as equally “respectable” and skilled scientists on one hand, and they provide enough different scientific opinions to enable discussion and comedy without being in direct rivalry with the male characters.

There is one scene that illustrates how humor can arise when putting two scientists of different disciplines into a setting and having them discussing the relevance of their disciplines (“The Zazzy Substitution” Season 4 Episode 3):

**AMY**
[…l] I meant compared to the real-world applications of neurobiology, theoretical physics is, what’s the word I’m looking for? Hmm, cute.

**LEONARD, HOWARD**
Oooh!

**SHELDON**
Are you suggesting the work of a neurobiologist like Babinski could ever rise to the significance of a physicist like Clarke-Maxwell or Dirac?

**AMY**
I'm stating it outright. Babinski eats Dirac for breakfast and defecates Clarke-Maxwell.

**SHELDON**
You take that back.

**AMY**
Absolutely not. My colleagues and I are mapping the neurological substrates that subserve global information processing, which is required for all cognitive reasoning, including scientific inquiry, making my research ipso facto prior in the ordo cognoscendi. That means it's better than his research, and by extension, of course, yours.

**SHELDON**
Excuse me, but a grand unified theory, insofar as it explains everything, will ipso facto explain neurobiology.

**AMY**
Yes, but if I'm successful, I will be able to map and reproduce your thought processes in deriving a grand unified theory, and therefore, subsume your conclusions under my paradigm.

**SHELDON**
That's the rankest psychologism, and was conclusively revealed as hogwash by Gottlob Frege in the 1890s!

("The Zazzy Substitution" Season 4 Episode 3)

There are no coherent arguments about whose science is the better one yet this short excerpt is merely an illustration of the fact that the validity of a discipline may be a question of standpoint rather than to be rationally discussed.

- ***Sociology and Geography***

Sociology and Geography are the other disciplines that are discussed in various conversations. Other than biology they have an immediate negative connotation to them. They are described as dubious sciences which makes them the perfect target for condescending comments about them from the physicists. They are lower in the hierarchy which is important as the fact that they can be presented as "un-scientific", physics on the other hand is reinforced as being the most legitimate science.

These disciplines are targets for ridicule and malice (e.g. calling geologists "dirt people") in "The Big Bang Theory", in order for the physicists to have a group of people they can look down on. The main characters are portrayed as being unpopular, weird and victims of bullying, so in order to make them leading characters they need to be in the focus. To overcome this perception of them being poor underdogs, they are given opponents to "torture" as well.

It might appear as though sociology and geology are misrepresented. They are the punch line of various jokes that aim at making them look irrelevant. This is one of the issues that the sitcom as a genre brings with it: the necessity of jokes. But jokes may reflect a wrong assumption/imagination

about the subjects used. Maybe not on purpose but just as a compromise, nevertheless the content of the joke might be misunderstood by viewers.

- ***Engineering***

Engineering has a special stance in between the different scientific disciplines, mainly because within the series there often is a discussion about whether or not it actually is a scientific discipline. As it has this "in between" status it hierarchically is probably somewhere in between biology and geology. As Sheldon argues, engineering is "the slow little brother of physics" and engineers are the "Oompa Loompas" of science, both of which indicate the way engineering is laid out as: a support of science. The relationship between physics and engineering is not shown to set up jokes or the like, as it is with biology. Occasionally Howard is ridiculed because of his occupation as an engineer, yet the main issue with engineering is that it is supposed to promote and support physics.

The main concern in using hierarchies within the storytelling of "The Big Bang Theory" seems to be the reinforcement of physics as a subject which is important, valuable and at a higher level than other disciplines in an imagined ranking. It also makes the characters appear more essential and powerful. It is a fictional scale that is used in order to have protagonists and antagonists set up in case there is a need for confrontation or argumentation. The fact that the disciplines are sort of ranked also allows for jokes, puns and comedic situations to be based "in science" instead of always having them arise in private situations.

## 9.2 Boundary work

> *"The boundary dispute between anatomists and phrenologists was a contest for the authority to call oneself a scientist and to claim scientific legitimacy for one's beliefs."* (Gieryn 1983)

The quotation above is taken from an article in which Gieryn talks about how phrenology was excluded from being a science by the negotiation of its boundaries. He argues that it was a discussion between the two groups whether phrenology could be included in "genuine" science as well. The negotiation of the boundaries of science is what separated science and pseudo-science. As Gieryn argues, boundary work is a concept that points out an ideological style that attempts to create a public image for science by contrasting it to non-scientific intellectual or technological activities (Gieryn 1983).

In terms of this thesis the concept of boundary work is also used under the aspect of negotiation; the difference is that in this context it is less about whether or not the content is scientific and accurate but about the boundaries of entertainment and education. While "The Big Bang Theory" certainly is a sitcom, it incorporates knowledge and explains scientific issues in a way that they can be understood and picked up by the attentive audience nevertheless. It behaves as a channel to communicate

science and scientific theories as well as acts as an entertainment tool. Yet, the boundary of presenting genuine knowledge is often drawn when humor comes into play. When jokes and other humorous devices are used, the sincerity of sound knowledge could be doubted and the boundary is drawn at those instances.

There is another “boundary issue” within “The Big Bang Theory”: the intermingling between the private and the professional. The characters are identifiable as scientists pretty much most of the time. They conduct experiments at the work place as well as their apartment so there is never really a distinction between the scientists and the private person. It is an invisible boundary and therefore easily crossed. Whether a situation can be regarded as private or professional is entirely dependent on the further context, the dialogue, plot and interaction of the characters involved. It is interesting though that the boundaries are blurred in regard of the private and professional approach especially when it comes to e.g. experiments. It shows a certain universality with which situations can be approached. In “The Cruciferous Vegetable Amplification” Sheldon could approach his wish for a prolonged life by deciding to quit eating unhealthy and exercise, but he chooses to also treat himself and his health as an experiment which can be observed and measured and eventually be replaced by a robot. His professional mixes with his personal life and the result is an entertaining story.

The object which is most often used to transform a private into more of a professional setting is the whiteboard. As can be seen in the very beginning of “The Cruciferous Vegetable Amplification”, the four white boards shown represent a mathematical analysis of Sheldon’s life expectancy. They transform his existence into a mathematically solvable equation but they also help to strengthen Sheldon’s profile as a scientist. In this first scene the living room is less of a recreational space but rather serves as Sheldon’s office.
In this respect they also negotiate the boundary between the professional and the personal. The question is personal; the solution professional in the mere specter of the board, but the board itself draws a boundary as well. It transforms the living room into an office and puts the focus on a professional behavior and demands certain kinds of actions. Whenever a whiteboard is part of a scene, people are gathered around it at some point, there usually is attention to it. It also demands explanation which is assumed to be of a scientific nature. The assumptions are bound to this object which by itself holds specific expectancies.

In a way the whiteboards can be regarded as "boundary objects" within "The Big Bang Theory". As Star and Griesemer claimed:

"*Boundary objects are objects which are both, plastic enough to adapt local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites... They have different meanings in different social worlds but still their structure is common enough to more than one world to make them recognizable, a means of translation*."(Star and Griesemer 1989)

The whiteboard is an object people are familiar with; it is an object which is commonly used in school or other educational or professional settings to help the communication between for example the teacher and the pupils. It is rather uncommon to encounter a whiteboard, especially in the size of the ones Sheldon own in people's private homes. If they are there, they are usually a lot smaller; they would serve as a means to remind the inhabitants of things. They would be used to note things. Yet, when the audience encounters the whiteboards in Sheldon's living room it is immediately clear that he is not scribbling down some notes. What is written down on them has a more serious background.

There is a boundary between the personal and the professional space which usually is indicated by infrastructure and setting. While a white board per se is not uncommon in households in general, a certain quantity and scale of them is. They indicate that there is less of a boundary between the two spaces to be found in this specific case.

### 9.2.1 Science and engineering

The boundaries that are negotiated are not just drawn around how professional- and personal life interact with each other. Another boundary that is often negotiated is that between science and technology. One of the mistakes that I often made in the beginning of the writing process of this thesis was that I assumed that technology was a simple byproduct of science. But that is not how it is; in fact they are two different things.

Yet they are not that easy to distinguish, at least not visually, which is evidence for me that their boundaries are not clearly outlined in this series, even though there are certain instances that might suggest otherwise. First of all there is the clear distinction between the three physicists and the one engineer, which is constantly reinforced by jokes. As I have pointed out in one of the previous subchapters there is a differentiation between how the characters are treated by the others and perceive their occupation themselves when it comes to engineering. I would say that Sheldon would share the early 20$^{th}$ century approach that engineering lacks the ability to contribute to the assemblage of "genuine" and "scientifically sound" knowledge, while Howard would believe that his work has a value and purpose and that it is just as important as the work his friends are doing.

Gieryn gives the example of how mechanics was separated from science in the beginning of the 20$^{th}$ century: the inventors and engineers were dependent on knowledge found by scientific inquiry, they

couldn't "explain" practical success or failure because they only used trial and error, and other than scientists, they seek personal profit not the discovery of facts (Gieryn 1983).

This example shows that science and engineering have quite distinct boundaries, there is one aspect that stands out in their relationship in the context of "The Big Bang Theory": their distinction and separation from one another does not necessarily translate into television. The fact that Howard's character "only" holds a Master's degree might be a reason for ridicule, but it remains unclear whether someone else with a Master's degree wouldn't be considered a scientist either. In theory a degree separates the scientists from the engineers but besides the different fields they are working in, the differentiation between them remains invisible. The perception of the main characters varies according to their personal characters but it is unlikely that viewers would explicitly separate Howard from the others. They all work in the same place, the all share an interest of the same things; the fact that they are not the same kind of experts is not a part of the immediate imagination of those characters.

Science and technology, at least the way they are portrayed in this series, work towards solving problems; with a shared goal. This can be seen whenever they need Howard to bring their ideas to life; in those scenes it becomes apparent that there is no visual evidence of who belongs to which group. If they wouldn't talk about it, the audience might be oblivious to the fact that they have different occupations.

The viewer can look at the characters and their relationship as a personification of science and technology and their relationship. They need each other. Leonard, Sheldon and Raj depend on Howard to complete certain tasks as well as science needs parts of engineering and technology to get certain jobs done. On the other hand, technology is directly related to science as much as Howard is in need of the other three scientists. They rely on each other and their bond strengthens both, science and technology.

# 10 Conclusions

*How is science communicated with „The Big Bang Theory“?*

The sitcom “The Big Bang Theory” is based on the lives of scientists. Science and technology therefore compose a lot of content featured within the show. Yet the show is not about educating its audience. The aim is not to put the focus on science and technology in a way that removes the importance of the story, but to enrich the storytelling by including scientific and technological content. The main issues at the core of every episode are rooted in everyday life; they are about situations that each viewer can comprehend even though they might not know the setting. In terms of the communication of science this brings a crucial factor into the genre of the sitcom: it makes things understandable.

The content of the whiteboards shown in “The Cruciferous Vegetable Amplification”, feature notes, equations and figures which are difficult to construe. Without the context of Sheldon’ explanation given to Leonard they would not make much sense; Sheldon’s elaborations and general behavior are better illustrated by being surrounded by those whiteboards. It is not essential for the viewer to know that the equations are in fact probability equations, which perfectly accompany the dialogue and provide an “accurate” depiction of Sheldon’s probability of dying. The interaction of all those factors transports the message regardless of whether the viewer can understand each of the different factors or not. The message is transported within the interaction and becomes clear when it is played out. This way it can be assured that the whole of the audience, regardless of their previous education or encounters with science, will be able to understand the issue at hand.

The genre of the sitcom works along its own rules which also affects the way science is presented. First and foremost the aim is to entertain the viewers. The average viewer tunes in for positive and humorous entertainment which means the issues that are rooted in science are not supposed to be controversial or disillusioning.

Science and technology featured on “The Big Bang Theory” are always presented in a positive way. The characters are never in serious danger because of a technology and science is never used to threaten or harm anybody. They are used to playing pranks on different characters yet those pranks are always presented to be fun (nobody gets hurt). Experiments shown often have a ridiculous and unprofessional touch at times, but they create a genuine atmosphere in which science and technology are tools for fun as much as they are for knowledge and education. The experiments do not have to work out and there are not always answers to every scientific problem Sheldon faces. In a sitcom failing is not a problem as it would be in other efforts trying to portray and communicate science.

In order to include science and technology into the plot and further content of “The Big Bang Theory” in a sophisticated yet genuine way some aspects have to be looked at with special care: the visual appearance, words and specific terminology, the experiments shown as well as the main scientist characters in general.

One of the “core ingredients” of a television show apart from the stories and the characters are the settings it takes place. In “The Big Bang Theory” the most important sets are Sheldon and Leonard’s living room, the cafeteria and the university in general. Those places have to be easily identifiable as what they are and at the same time have a specific touch so that they can immediately be associated with the series.

Just like the stereotypes of scientists the stereotypes of their working places are also differently portrayed in “The Big Bang Theory”. There are no fuming bottles and petri dishes to be found in the offices and laboratories of the characters (which is also due to the fact that they are physicists/engineer and not biologists or chemists or the like) but rather there are big machines, lasers, telescopes and whiteboards. In one scene the living room is just a living room, but when Sheldon scribbles equations on four different whiteboards, the living room is transformed into some kind of laboratory. By using a simple tool like for example the whiteboard a private place can be transformed into a professional one, which can be a subtle way to implement scientific and/or technological content into almost any kind of scene.

The visual content is complemented by specific vocabulary and terms which also help to integrate science and technology into “The Big Bang Theory”. Even though scientific as well as technical terms are not part of everyday language this sitcom uses them in general conversations, because illustrating visuals and jokes give those terms and vocabulary more context and content and make them easier to understand. While certain terminology may exclude some audience members it nevertheless may help to include others and connect them to the show and the people being portrayed. This kind of language appears including to those people in the audience who share it, but in interaction with visuals, storyline and character behavior it can draw viewers in as an opportunity for humor as well. The terms and vocabulary paint a picture of science and technology as well; what exactly it portrays is in the eyes of the beholder.

The same goes for humor, not everybody laughs at the same jokes and even if they do, they might do it for different reasons. Some people laugh because they thought the joke was funny, others laugh at the same instance because they cannot understand the core of the joke but are carried away by laughter. As long as there are possibilities for every viewer to laugh, the sitcom succeeds as a genre.

For most of the conversations an exact understanding of specific terms and vocabulary is not required in order to be able to follow the storyline. It is interesting however, that whenever a character (mostly Sheldon) uses an extensive amount of it his part is "translated" by the other people he is in a conversation with. This way it becomes clearer what the intentions of the character were and the story is being propelled at the same time.

Especially the character of Sheldon is equipped with an attachment to science and technology which exceeds those of the other characters. It appears to be rather easy to embed a scientific or technological storyline or issue as long as it is directly related to Sheldon. This "procedure" does not require a long backstory or explanation. If Sheldon wants to replace himself with a robot, there is no reason to doubt his motives, as the viewers will be able to interpret his behavior according to the one they have witnessed in prior episodes.

This can also be seen in the instances of the characters participating in various kinds of experiments. The fact that experiments are done in the living room of Sheldon and Leonard's apartment is something the viewer is familiarized with early on in the series. It adds to an eased portrayal of both the scientists as well as the science presented in "The Big Bang Theory". The experiments shown add a visual component to science which makes it more graspable for the audience. While they differ from experiments which can be encountered in e.g. school, they still aim at illustrating a specific phenomenon or the like, only that they may not necessarily be really "scientific". For example when the audience witnesses Sheldon experimenting with eggs and toast, the experiment itself is used to illustrate his wish to work rather than to show how to make perfect toast and eggs. The experiment during which Leonard, Sheldon, Howard and Raj shoot laser beams off their apartments roof ("The Lunar Excitation" Season 3 Episode 23) has a specific scientific background but within the episode is used to illustrate the difference between the scientists (Leonard, Sheldon, Howard , Raj) and the lay people's (Penny, Zach) perceptions of the experiment. From this point of view the experiments are a means of visualization that exceeds purely scientific- but also includes personal content.

This approach makes them universally applicable. The experiments conducted are not bound to one place and can be adapted to the needs of storytelling without taking away their sincerity, even though they often appear to be conducted in Leonard and Sheldon's apartment because of the convenience of the place (e.g. egg and toast experiment) or because it is more secluded (e.g. when they attempt to repair a space toilet Howard already installed) or because the experiments are not "serious" enough (e.g. cornstarch dancing on speakers) to conduct them in a university environment.

In regard to the characters it has already been mentioned that they, and especially their interest and engagement in science and technology, help to transport ideas and content into the stories told. But

the characters never the less are an important by themselves as well. They portray a “new”/ different kind of scientists.

The typical scientist on television used to be a middle aged, white male in a white lab coat married to their research. The main characters in “The Big Bang Theory” do not fit into this stereotype; they are young , wear t-shirts and have interest outside of science. At first sight they may not be identifiable as scientists because they lack the visual evidence, yet their behavior and the way they talk with each other gives them the charisma of scientists. In a way it could be argued that these characters are an elaboration of the mad scientist. While they are mad/ weird in some respects they never the less do not seem to pose a threat to others. They are likeable characters, and certainly portrayed to be successful scientists as well, but they are also portrayed to be very human, with strengths and weaknesses. This vulnerability is essential for characters in a television show as it is the source for various angles of storytelling, but it also gives the characters a depth which scientists in fictional television series are rarely provided with.

The image the viewer receives of the scientists in “The Big Bang Theory” is one that is not based in an extreme, the characters are not black and white/ good and bad kinds of scientists, but like people in real life they have positive and negative characteristics they bring into their profession as scientists. In this regard the sitcom provides a somehow “realistic” picture of scientists in contrast to other portrayals where the characters have to be more distinct to match specific storytelling needs.

In the case of the sitcom it is important that the viewer can identify with the characters to a certain degree. While they might not be familiar with the specific context Sheldon, Leonard, Howard and Raj find themselves in, they never the less can identify with situations dealing with competition, hierarchies, anger, frustration, rejection and the like. Even though the main characters are members of a specific social group they can be seen as identification figures for audience members dealing with those issues and feelings in another context.

Because of the characters, this sitcom features an interesting approach to communicate science: a personal approach. The main characters live and breathe science in a way that benefits their lives beyond their professional careers. The fact that they conduct experiments in their living spaces and use technology to facilitate their daily lives illustrates that science and technology can be part of people’s passions too. Science and technology are not just a job but also a hobby for the characters, they are personally invested in their professional as well as their personal work which becomes apparent whenever their “secret projects” fail. This represents a kind of passion audience members may also be able to relate to.

This personal approach also places science and technology into a more “casual” way of communication. The focus is on the characters and the aim is to entertain the audience therefore the serious side of science is outweighed by the possibilities they bring to possible jokes. They are not exploited though; the focus in terms of the staging and communication of science and technology is to show that they can be approached with humor without being less genuine.

The visualization of science and technology is another special “ingredient” the sitcom is able to add to the communication of science and technology. As already mentioned there are various ways to visualize science it can either be it in a joke, it experiments or objects (whiteboards, the mobile virtual presence device) or it can be a conversation between two characters about whose research subject is more relevant. The incorporation of science and technology into banal situations of everyday life is what makes them visible to the audience. Science in this specific context is presented as an applicable tool, not as knowledge hidden behind closed doors. Technologies like the mobile virtual presence device are used instead of only presented. They are shown with their benefits as well as their disadvantages, which might not be the case if they are a subject of other efforts of science communication. The same goes for the science presented. The freedom that the sitcom presents is that it does not aim to “promote” the issue portrayed, but wants to incorporate it into comedic purposes.

For example in “The Cruciferous Vegetable Amplification”, the mobile virtual presence device is not necessarily portrayed to be an assent for Sheldon’s life. In the realm of the sitcom it does not have to be, for comedic purpose it is an advantage that the mobile virtual presence device holds certain flaws and does not necessarily improve Sheldon’s situation. Still it is not presented in a negative way. The sitcom may not require a meticulous account of the technology or science used but it needs them to be portrayed in a positive and controversial free manner.

“The Big Bang Theory” communicates science and technology in a casual and positive way. The main characters are the carrying forces of the plot as well as the content and embody the passionate scientists who can identify with their work. They allow for a personal approach in terms of the storytelling which in return makes the content more relatable for the audience.

In terms of its contribution to science communication, the sitcom and “The Big Bang Theory” in specific can be noted in regard of the audience they attract. As they address a very broad and diverse audience they constitute a platform for reaching out to people who would not necessarily come into contact with science and technology in this context otherwise. “The Big Bang Theory” facilitates the entry into the topic to a certain degree as it presents science as something relatable, fun and easy to understand.

To see science through the eyes of a sitcom makes some aspects seem less professional but on the other hand makes them more relatable as well. While the audience cannot expect to see a hundred per cent accurate versions of how “science” would work in real life, they might at least get an easily understandable version of what “scientific life” would look like. The sitcom tells a story and besides the issues being presented. But they also put science and technology into a concrete context, which is hard to do in other form of science communication (for example newspaper articles). The format allows playing absurd as well as concrete and “real” situations through and illustrates the usage of things science and technology in a way that is entertaining to watch.

The sitcom presents science and technology as subjects that are both fascinating and entertaining and they are used to create stories and engage different characters. They cover those topics in an attempt to spark an interest in people and show that science and technology can be entertaining as well.

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# Appendix

## I. Index of figures



## II. Index of Episodes

| Name | Season | Episode | Director | Story by |
|---|---|---|---|---|
| The Luminous Fish Effect | 1 | 4 | Mark Chendrowski | Bill Prady<br>Chuck Lorre |
| The Jerusalem Duality | 1 | 12 | Mark Chendrowski | Jennifer Glickman<br>Stephen Engel |
| The Barbarian Sublimation | 2 | 3 | Mark Chendrowski | Nicole Lorre |
| The Griffin Equivalency | 2 | 4 | Mark Chendrowski | Bill Prady<br>Chuck Lorre |
| The Killer Robot Instability | 2 | 12 | Mark Chendrowski | Bill Prady<br>Richard Rosenstock |
| The Friendship Algorithm | 2 | 13 | Mark Chendrowski | Bill Prady<br>Richard Rosenstock |
| The Financial Permeability | 2 | 14 | Mark Chendrowski | Chuck Lorre<br>Steven Molaro |
| The Dead Hooker Juxtaposition | 2 | 19 | Mark Chendrowski | Steven Molaro |
| The Classified Material Turbulence | 2 | 22 | Mark Chendrowski | Chuck Lorre<br>Lee Aronsohn |
| The Gorilla Experiment | 3 | 10 | Mark Chendrowski | Chuck Lorre<br>Richard Rosenstock<br>Steven Holland |
| The Einstein Approximation | 3 | 14 | Mark Chendrowski | Lee Aronsohn<br>David Goetsch<br>Steven Holland |

| | | | | |
|---|---|---|---|---|
| The Precious Fragmentation | 3 | 17 | Mark Chendrowski | Lee Aronsohn<br>Eric Kaplan<br>Maria Ferrari |
| The Lunar Excitation | 3 | 23 | Peter Chakos | Chuck Lorre<br>Bill Prady<br>Maria Ferrari |
| The Cruciferous Vegetable Amplification | 4 | 2 | Mark Chendrowski | Bill Prady<br>Lee Aronsohn<br>Steven Holland |
| The Zazzy Substitution | 4 | 3 | Mark Chendrowski | Chuck Lorre<br>Bill Prady<br>Jim Reynolds |
| The Bus Pants Utilization | 4 | 12 | Mark Chendrowski | Chuck Lorre<br>Lee Aronsohn<br>Maria Ferrari |
| The Benefactor Factor | 4 | 15 | Mark Chendrowski | Bill Prady<br>Lee Aronsohn<br>David Groetsch |
| The Russian Rocket Reaction | 5 | 5 | Mark Chendrowski | Bill Prady<br>Steven Molaro<br>Jim Reynolds |

## III. Abstract

The following thesis “ENCOUNTERING SCIENCE IN A SITCOM- How ‘The Big Bang Theory’ stages science” approaches the question how science can be embedded into the genre of the sitcom and the advantages and disadvantages the communication of science in such a format can have as it exposes the content to a very varied audience.

Science communication in the media, especially in feature films, has been an extensive source of research especially in regards to its history (LaFollette 1990; LaFollette 2013) and scientific and technological depictions (D. Kirby and Gaither 2005; D. Kirby 2010), but also the stereotyping of scientists in entertainment media in general (Haynes 2003; Long, Boiarsky, and Thayer 2001; Losh 2010; Weart 1988)

Previous research in the field of entertainment television and science however has not found its way into formats like sitcoms or the like; formats that are not grounded in the dissemination of knowledge but in efforts to entertain the audience.

The idea of this thesis is to have an in-depth look into at how scientific and technological knowledge as well as imaginations of both are embedded within efforts of entertainment television and to determine what they may present to a diversified audience of lay people as well as experts.

In order to do so, I analyzed one specific episode of the sitcom “The Big Bang Theory” as well as several scenes from other episodes to point out certain issues and characteristics; also I tried to re-construct the efforts made by producers, writers and show runners by deliberately choosing scientists as the main characters of their show.

What I would like to show with this thesis is that the sitcom and its relation to humor is also a medium that might have a certain relevance to communicating science especially as it has the advantage of reaching an audience that is varied in age, territory, class and culture.

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Die Folgende Arbeit “ENCOUNTERING SCIENCE IN A SITCOM- How ‘The Big Bang Theory’ stages science” nimmt sich der Frage an, wie Wissenschaft in das Genre der Sitcom integriert werden kann und welche Vor- und Nachteile sich dadurch für die Kommunikation von Wissenschaft ergeben können. Besonders unter Anbetracht der Tatsache, dass die Sitcom ein breites Publikum erreicht.

Der Fokus von Wissenschaftskommunikation in Unterhaltungsmedien was bislang der Film, weshalb der Großteil der Literatur in dessen Geschichte (LaFollette 1990; LaFollette 2013) und der Darstellung von Wissenschaft und Technik (Kirby and Gaither 2005; Kirby 2010), sowie der Darstellung von Wissenschaftlern im Film (Haynes 2003; Long, Boiarsky, and Thayer 2001; Losh 2010; Weart 1988). Formate wie die Sitcom, die sich nicht explizit mit der Vermittlung von Wissen befassen, sind noch kaum unter dem Gesichtspunkt ihres Einflusses auf die Wissenschaftskommunikation behandelt worden.

Die vorliegende Arbeit möchte an diesem Punkt ansetzen und zeigen, dass auch Unterhaltungsfernsehen zur Kommunikation von Wissenschaft und Technik beitragen kann. Um dies zu zeigen wurde eine Beispielhafte Folge der Sitcom „The Big Bang Theory“ diskutiert und auf ihre Berührungspunkte mit Wissenschaft und Technik analysiert.

## IV. CV


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### EDUCATION

**University of Vienna, Social Studies of Science and Technology**, Vienna, Austria
*Master of Arts (MA)* *November 2014*
Relevant Courses: Specialization in Science Communication; Master thesis on the compatibility of an entertainment medium (the sitcom) and scientific knowledge

**University of Applied Sciences FH Technikum Wien,** Vienna, Austria
*Bachelor of Science in Engineering (Bsc)* *June 2010*
Relevant Courses: Specialization in Tissue Engineering; Bachelor thesis on Biodegradable scaffolds used in bone regeneration

**Secondary School - Sacré Coeur Pressbaum**, Pressbaum, Austria
*Matura* *1999- 2007*

### EXPERIENCE

**European Forum Alpbach**, Alpbach , Austria
*Intern* *July – August 2012*
- Assistance of the project managers responsible for the economic and politic symposium
- Researching, writing and editing of information material handed out to panelists
- Helping with the set up and monitoring of panels

**Radio 88.6**, Vienna, Austria
*Intern at the editorial department* *June 2011*
- Setting up, recording and cutting of interviews
- Researching, reviewing and writing traffic news
- Conducting opinion polls
- Processing incoming calls by the listeners (questions, requests, contests)

**Biomarker Design Forschungs GmbH**, Vienna, Austria
*Intern* *March 2011-May 2011*
- Assistant of the head researcher
- Working on own project to purify Antibodies
- Writing of a Standard Operating Procedure for the use of purifying Antibodies

**Medical University Vienna**, Vienna, Austria
*Internship required for Bachelor degree* *January 2010- April 2010*
- Work on a study that investigated the effects of a thorax support vest on the recovery process of patients undergoing sternotomy
- Researching and building a 3D model of a human thorax
- Measuring and analyzing the distribution of pressure on the thorax with and without the thorax support vest

### ADDITIONAL INFORMATION

Language Skills: German (native), English (fluent), French (competent).
Computer Skills: Proficient user of MS Windows, basic understanding of C+ and C#.
Other Interests: Sports: Tennis, Running, Yoga; Writing: participant at several writing competitions
Stay Abroad: July- December 2010 Paris