Credibility of Science Communication

An Exploratory Study of Press Releases in Astronomy

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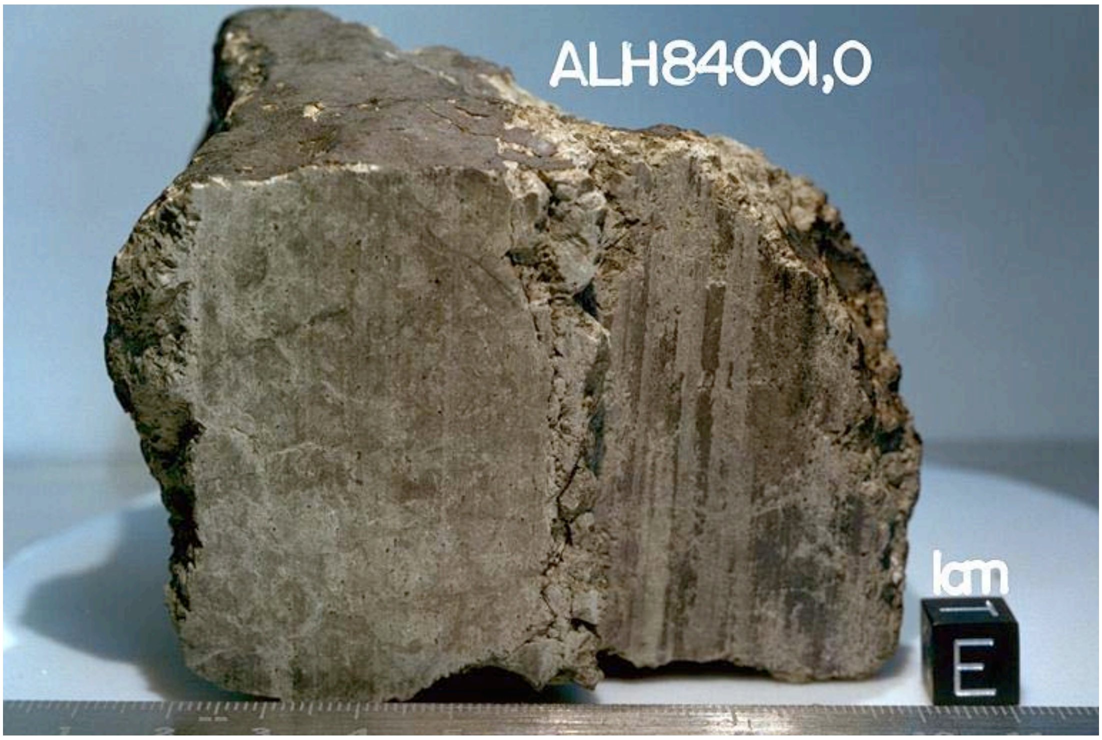

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Cover image: Photo of ALH84001, a Mars meteorite suspected of containing fossil evidence for microorganisms (see the glossary for more details) – Credit: NASA.

Abstract

Twelve qualitative open-ended in-depth interviews with public information officers from large governmental scientific institutions as well as scientists and journalist were conducted in November 2005. An analysis of the interviews is carried out, to study how far science communicators in the name of science communication can, or should, push, without damaging the individual, and thus also the collective credibility, of the science communication community and the involved institutions. Overall the study suggests that a credibility problem for astronomical press releases does not exist. However the interviews indicated a problem within the scientific community, where some lack of understanding and respect among the actors is found. All actors though, showed great attention and concern for communicating science in a credible way. A code of conduct presenting guidelines for how to minimize hype in press releases is presented.

Keywords: credibility, hype, science communication, astronomy, visibility and press releases.

Abstract (Danish)

Tolv kvalitative dybdegående interviews med åbne svarmuligheder blev gennemført med journalister, forskere og informationsmedarbejdere fra store forskningsinstitutioner. Interviewene analyseres for at undersøge hvor langt informationsmedarbejdere kan, og bør, gå, før de skader både den individuelle, såvel som den kollektive troværdighed i det videnskabelige samfund. Generelt tyder studiet på at der ikke eksisterer et troværdigheds problem for astronomiske pressemeddelelser. Dog antyder interviewene et problem internt i det videnskabelige samfund, idet visse mangler på forståelse og respekt aktørerne imellem blev fundet. Alle aktører udviser stor interesse for at formidle videnskab på en troværdig måde. Et kodeks som kan hjælpe til at minimere hype, præsenteres.

Nøgleord: troværdighed, hype, naturvidenskabsformidling, astronomi, synlighed og pressemeddelelser.

Contents

Preface

This report has been prepared as part of 3rd semester at the Basic Studies in Natural Sciences at Roskilde University within the semester subject: “Reflections on science and science communication”.

The method we have employed in this report, has been motivated by methods employed in comparative studies (Treise & Weigold, 2002; Dumlao & Duke, 2003), as well as methodologies described in (Kvale, 1996).

We decided to write this report in English, as we interviewed twelve science communication professionals from United States of America and Europe during this project. Consequently, we wanted our interviewees to be able to read the outcome of the project.

In the preliminary studies for this report, we focused on both conducting interviews and investigating case studies. However, as the work progressed it became clear, that a thorough investigation of several case studies would need an entire report in itself. As a result, we decided to focus on analysing the interviews. Nevertheless, the case studies were indispensable for our own understanding of the problems examined in this report.

The examples presented in this report have not been chosen to criticize a special institution, communicator or scientist, since they are only of random examples out of other cases involving other institutions, communicators and scientists. It is not our intention to judge what is right or wrong in examples, but merely identify the potential conflicts and credibility problems.

Acknowledgements

We are grateful to ESA/Hubble and Roskilde University for funding of travel to Germany and USA, and ESA/Hubble for funding of accommodation in Germany and USA. This allowed us to conduct interviews with some of the most recognized and experienced professionals in astronomy science communication. Without the funding we would not have been able to carry out this project as it is today.

We would like to thank the following for giving hour-long interviews and for lot of good advice, even though time is a scarce commodity for all them. Without the willingness of the interviewees we would not have been able to carry out the project with the chosen methods.

- Dr. Peter Edmonds, Chandra X-Ray Observatory.
- Dr. Robert Fosbury, Space Telescope European Coordinating Facility.

- Prof., D.Sc. André Heck, Strasbourg Astronomical Observatory.
- Dr. Robert Hurt, Spitzer Science Center.
- Dr. Bruno Leibundgut, European Southern Observatory.
- Dr. Mario Livio, Space Telescope Science Institute.
- Mr. Dirk H. Lorenzen.
- Mr. Claus Madsen, European Southern Observatory.
- Mr. Govert Schilling.
- Dr. Neil DeGrasse Tyson, Hayden Planetarium.
- Mr. Ray Villard, Space Telescope Science Institute.
- Ms. Megan Watzke, Chandra X-Ray Observatory.

Most of all we would like to thank our external supervisor Lars Lindberg Christensen[1] (ESA/Hubble) for inspiration and being able to establish contact for us with the interviewees. Lastly, we would also like to thank our supervisor at Roskilde University, Prof., D.Sc. Birgitte Munch-Petersen[2], for support and help with funding from Roskilde University.

Sanne Bjerg has due to illness in December been unable to participate fully in the writing of this report. Until December Sanne participated fully in the project, together with the other authors, and has thus participated in all the preliminary studies and transcription of the interviews. During the writing of the report Sanne has contributed with drafts for the Introduction, Method and parts of the Analysis. Only small parts of the drafts, except section 1.2 "Short History of Science Communication", did however reach it into the final report, as we in mid-December had to re-structure and re-write the entire report from the Method and onwards. Sanne has also contributed with proof reading of the report.

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[1] See http://www.eso.org/~lchriste/larsbio.pdf.

[2] See http://virgil.ruc.dk/~bmp/.

Readers Guide

The report is divided into the following chapters

- Introduction
- Method
- The Communication Process
- Case Study: The NASA 1998 Extrasolar Planet
- Analysis
- Discussion
- Conclusion
- Appendix

Notations

- Glossary words are in **bold** the first time they appear in the text.
- Quotes from the interviews are in *"italics"*.
- Key points are also emphasized with *italics* but without quotation marks.

We both use quotes and citations when refering to the conducted interviews. The quotes are given with last name of the interviewee. However, for the citations we also cite articles written by some of our interviewees, but note that all interview have been conducted in 2005 and mostly that the articles have been published earlier than 2005. Thus, e.g. the citation (Heck, 2000) refers to an article whereas the citation (Heck, 2005) refers to the interview which are available in the Appendix B.

Technical Prerequisites

The reader is assumed to have an interest in (popular) science communication as well as in popular astronomy. Basic knowledge of **qualitative research** methods and the theory of science communication is an advantage however not a prerequisite. Readers less experienced with these areas may find the glossary helpful.

Target Group

The report is targeted at the different science communication actors: scientists, science communicators and the media. The aim is that this report can be used as a fruitful contribution in the ongoing discussion of credibility of science communication.

1 Introduction

"Any chink in the armour of credibility can make the entire scientific community vulnerable to attack" – Robert Hurt.

Science communication acts in the modern market place and competes with large commercial communication players such as computer game industry. The pressure on the communication actors is larger than ever, and the temptation for overstating the importance of scientific results (normally referred to as hype) is huge. This development inevitably leads to science communication with more spin, more push and shorter time from scientific results to publicly communicated results.

Two of the most well known examples of overstating scientific results, are the "Mars meteorite" case and the "Cold fusion" case. In 1996 NASA announced that a Mars meteorite, suspected of containing fossil evidence for microorganisms on Mars, was found (NASA, 1996). Many in the scientific community questioned this extraordinary claim, and it took only a few months before the first paper, questioning the results, was published (Kerr, 1996). NASA received a great amount of media attention, and according to some communication actors, the timing of the news was conspicuously close to the vote of further funding on Mars missions in the Congress (Heck, 2005). Today the claim has been rejected by most of the scientific community (Jeffs, 2004).

In March 1989 the two chemists, Stanley Pons and Martin Fleischmann, claimed to have had success in creating energy from a fusion process taking place at normal room temperature. They got worldwide media coverage for solving the world's energy problems, however many scientists tried to replicate the experiments, but attempts failed and none managed to replicate the cold fusion results. It was an *"extraordinary claim that requires extraordinary evidence"* (NOVA, 2005), as **Carl Sagan** would have said. Furthermore Pons and Fleishmann did not publish their results in a refereed paper and did thereby not follow the 'normal' scientific process (Gregory & Miller, 1998).

However a recent public opinion analysis have shown that the Europeans generally see scientists and reporters as having a positive impact on society (European Commission, 2005). This does not mean that the Europeans fully trust the scientists and reporters but it is a good indication that the Europeans view scientists and reporters as credible.

1.1 Aim of the Report

One of the most actively discussed issues in science communication today is: How far can and should science communicators in the name of science communication keep pushing, or promoting, science results or projects without damaging the individual, and thus also the collective credibility, of the science communication community and the involved institutions?

We have chosen to study the aim of the project presented above within press releases in astronomy. We will concentrate on seeing the problem from the science communicators' point of view, and other communication actors working in close co-operation with the science communicators. This delimitation is chosen while the science communicators deal with the scientists, but also with the journalists. This means that the science communicator is in the centre of the communication process, which will enable us to view the problems from the perspective of all communication actors.

1.2 Short History of Science Communication

The social distinction between science and the public began with the industrialisation of science in the 17th century with the science revolution. By the beginning of the 20th century popular science was well established (Gregory & Miller, 1998, p. 20-27). During World War II much science communication ceased in order to prevent other states from benefiting from new technology or science. The scientists' mysterious work, during the war, gave them a heroic image (Gregory & Miller, 1998, p. 34-35). After the war the journalists became the communicators of science to a larger extent, which parted the scientists and the public even further. During the post-war time the media coverage of science experienced a boom (Gregory & Miller, 1998, p. 37-39). The astronomy interest e.g. peaked in the early 1960s (Gregory & Miller, 1998, p. 119) with the Moon race.

Scientists have become more likely to communicate, since they have become aware of the benefits of communication to the public. More visibility can result in more money to the science. This visibility turned to be essential while the financial support from the military declined during the 1980s in the US (Nelsen, 1998). Since the members of congresses and parliaments are not scientists and they are the people voting on funding for science, scientists saw the advantages in communicating to the public (Tyson, 2005).

Since the 1960s science communication has changed. The journalists see themselves less as missionaries for science and more as critics and commentators (Gregory & Miller, 1998, p. 45) and it has become more difficult to catch the general public's attention because of a extended variety of news outlets (Tyson, 2005). Furthermore science now has a very different importance in media, as the coverage is more limited (Brier, 2002, p. 159) and therefore the competition among science institutions are increasing.

2 Method

"It matters to me what matters to them, because I will use this to communicate to them" – Neil DeGrasse Tyson.

We employed in-depth interviews to do an exploratory study of the main issues in science communication credibility. Furthermore we use one case study of questionable aggressive science communication for relating responses to our research questions with previous practice in the field.

2.1 Study Design

This report was inspired by the credibility panel discussion, "Keeping our credibility: Release of News", held at the conference "Communicating Astronomy with the Public 2005" in Munich in June 2005[3]. In our study we have chosen to conduct a series of in-depth interviews with public information officers from large governmental scientific institutions as well as scientists and journalists closely involved in the work of public information officers. We have also chosen to conduct in-depth interviews with other science communicators, truly devoted to communicating astronomy and sociological issues in astronomy, to explore the point of view from scientists who have become communicators.

A **qualitative** approach (e.g. interviews) was chosen over a more **quantitative** (e.g. questionnaires), because we, as supported by similar studies (Treise & Weigold, 2002), wanted to identify and understand issues as experienced by the involved communication actors. The qualitative approach, would allow us to adapt to many kinds of responses and explore uncovered issues in greater detail. Furthermore we assumed, that by conducting face-to-face interviews we could ask more penetrating questions to sensitive issues and thereby explore the more important issues in greater detail.

This report can be used as basis for designing quantitative studies of credibility.

2.1.1 Research Questions

Based on our preliminary studies we posed the following six research questions:

1. How do the communication actors define credibility and hype in science communication?
2. In which situations do the communication actors experience hype?

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3 Web cast of the panel discussion and subsequent wide-ranging and lively discussion is available at http://www.communicatingastronomy.org/cap2005/programme.html.

3. How do the communication actors experience the consequences of hype?
4. When should science communicators go public with scientific results?
5. Do the communication actors experience that credibility problems exist in science communication today?
6. How would a recommended Code of Conduct for press releases in astronomy look like?

These six research questions formed the basis for the topics to be covered during the interviews. One of the main goals of this exploratory study is the recommended Code of Conduct. The code of conduct will be developed to guide science communicators in their daily work producing press releases, and for evaluation of cases of questionable aggressive science communication. The code of conduct should not be regarded as a set of rules, but merely as a set of guidelines or an ethical charter.

2.2 Interviews

As described earlier we conducted qualitative **open-ended** in-depth interviews with the interview guide approach (Kvale, 1996, p. 129), meaning that the topics of our interviews was specified in advance and that the responses from the interviewees were open-ended and not restricted to choices provided by us.

In total we interviewed twelve persons of whom eleven were interviewed face-to-face and one[4] was interviewed by phone. The face-to-face interviews was conducted between 25th of October and 7th of November 2005 at European Southern Observatory in Munich, Space Telescope Science Institute in Baltimore, Hayden Planetarium in New York and at the "Six Years of Science with Chandra" symposium held in Boston, Massachusetts. The phone interview was conducted the 16th of November.

Each interview lasted approximately for one hour, was recorded digitally with the verbal permission of the interviewee and was conducted by one or two interviewers, both knowledgeable about the topics of the interviews. One interview was conducted with two interviewees[5] who were colleagues and close collaborators.

2.2.1 Interviewees

The interviewees was selected with the help of our external supervisor, who as a science communication professional for the Hubble Space Telescope in Europe has extensive knowledge of the science communication community within astronomy, as well as many professional contacts in the same community. As a result, our external supervisor was able

4 Mr. Schilling.

5 Ms. Watzke and Dr. Edmonds from Chandra X-Ray Observatory.

to establish contact with persons matching our criteria. All interviewees were chosen from one of the following groups (as describe in section 2.1):

- Public information officers from large governmental scientific institutions.
- Scientists closely related to the public information officers work, either as scientific support in the development of press releases (outreach scientists) or as evaluator of the public information officers' work.
- Science journalists specialized in astronomy.
- Scientists that have become communicators and who are devoted to sociological issues in astronomy or communication of astronomy.

Besides choosing interviewees who can be categorized as a member of one of the described groups, we also wanted interviewees from both Europe and the United States of America, to be able to explore possible differences. Table 2.1 presents all of our interviewees, their affiliation and the group we have categorized them in. Short biographies for each interviewee are available in Appendix B.

Name	**Affiliation**	**Interviewee Group**
Dr. Robert Hurt	Spitzer	PIO
Claus Madsen	ESO	PIO
Ray Villard	STScI	PIO
Megan Watzke	Chandra	PIO
Dr. Robert Fosbury	ST-ECF	Scientist
Dr. Bruno Leibundgut	ESO	Scientist
Dr. Mario Livio	STScI	Scientist
Dr. Peter Edmonds	Chandra	Scientist
Dirk Lorenzen	German Public Radio	Science journalist
Govert Schilling	Freelance	Science journalist
Prof., D.Sc. André Heck	Strasbourg Astronomical Observatory.	Scientist/Communicator
Dr. Neil DeGrasse Tyson	Hayden Planetarium	Scientist/Communicator

Table 2.1 *Categorization of interviewees.*

2.2.2 Analysis of Interviews

In short, we followed seven steps in the analysis of the interviews:

1. Reduce raw information (transcribe selectively).
2. Re-reduce raw information (re-transcribe selectively).
3. Identify interesting themes for each interview.

4. Compare themes across interviews.
5. Condense interviews to statements.
6. Validate statements against raw information.
7. Receive interviewee's approval of statements.

1) After all interviews were completed, four coders knowledgeable about the topics of the interviews transcribed each interview selectively, meaning irrelevant information was left out and that the interviews were not transcribed word by word. By irrelevant information is meant statements, which were not relevant to shed light on the posed research questions. 2) Each interview was then transcribed once again using the same method, but by another of the four coders to reduce the chance of missing important information. 3) Themes were then identified for each interview by the coders, meaning that the transcription was examined for descriptions, ideas, patterns, observations or interpretation of phenomena that could shed light on our research questions and main aim of the report. 4) The identified themes for each transcription were then compared across all interviews. 5) Each interview was then further reduced with the aid of the identified themes to a list of statements, which 6) afterwards was validated against the raw information to ensure that the statements did not misrepresent the interviewee. 7) Last, each list of statements was sent for approval by the interviewee, to validate the reduction process described above.

The condensed statements (available in Appendix B) were then subject of an analysis, which is the topic of Chapter 5.

3 The Communication Process

"As communicators we tell the truth, nothing but the truth, but not necessarily the whole truth." – Peter Edmonds.

Before we take a more thorough look into credibility problems in science communication, it is necessary to describe the context – how and by whom, science news is communicated to the general public. This chapter only covers the normal communication process for dissemination of news from larger scientific institutions, and not potential problems that may arise in the process.

3.1 The Simple Linear Model

There exist several both simple and sophisticated models to describe the dissemination of science news (Gregory & Miller, 1998, p. 86-88). However, since science news may be communicated by many different methods, in many different situations and to many different audiences, it is difficult to fit every aspect of science communication into one model. Science news in the media may e.g. *originate* from many different sources such as:

- Press conferences and press release from scientific institutions.
- Scientists giving public talks.
- Science journalist doing their own story research in journals
- Preprints services like **astro-ph**.
- Journalists attending scientific conferences.

The reporting of science news in the media is at many different levels depending on the audience's interest and scientific literacy. Science news in TV and press may be quite different from a feature article in e.g. National Geographic.

3.1.1 Overview of Model

One of the most used models is the simple linear model in which information flow starts at the scientist and ends up at the general public (Christensen, 2006). Before the general public receives the message, the information is passed through two other communication actors: the public information officer and the journalist (see Figure 3.1).

According to (Madsen, 2003) and sources quoted therein, studies have found that nearly 50% of science news in the media have direct links to a press release from a scientific institution. This means, that a large fraction of big science news in the media actually comes from a public information officer and has passed through the actors as the simple linear model describes – at least to a first approximation. The simple linear model described here, is sufficient in our case to describe the normal communication of big news and possible credibility problems related the communication process, which we are working with.

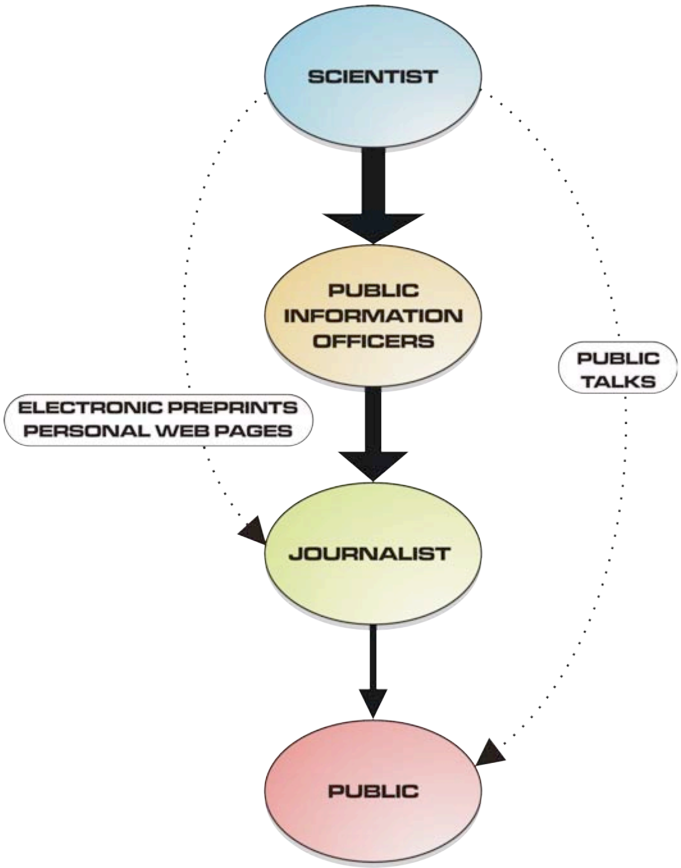


Figure 3.1 *Illustration of the simple linear model for the communication process – Credit: Christensen (2006).*

Naturally there exist cases and interactions between communication actors that the simple linear model is unable to describe, and because the model is a quite rough simplification, it does not take e.g. the complex nature of the general public into account. There also exist decision makers and other scientists in the general public which aggressive science communication may intentionally influence or unintentionally offend.

The following sections describe the communication flow for each communication actor. For completeness we should mention that more sophisticated models for the communication process are described in (Madsen, 2003; Mahoney, 2005).

3.1.2 The Scientific Process

A cursory understanding of the scientific process is important to understand communication of scientific information. The scientific process starts with a scientist who has have done some research that has resulted in interesting findings. When a scientist decides to publish his or her scientific results in a scientific journal, there are different steps to go through to ensure scientific accuracy.

First of all the scientific paper will be peer reviewed, this is a process in which other scientists read the paper and check for accuracy. The scientists, who referee the paper, can now either accept the paper or send it back for further corrections by the scientist. Peer reviewing ensure that errors, which might not be caught by the scientists, will in an ideal world be found before a possible publish in a scientific journal. When the scientific paper has been accepted, which can take between a few month and up to a few years in rare circumstances (Gregory & Miller, 1998, p. 108) the paper is now ready to be published in a scientific journal. In the scientific community results are normally not published to the public before the paper has been accepted. This principle is known as the Ingelfinger rule, which is named after the former editor of New England Journal of Medicine, Franz Joseph Ingelfinger (1910-1980). Since 1969 the Ingelfinger rule has been known as the scientific protocol (Toy, 2002).

Most scientific results are incremental improvements of earlier work of others, and will furthermore be superseded by newer and better results after few years.

3.1.3 The Work of Communicators

After a paper has been published in a scientific journal, it is the public information officers job to judge if the result has interest to the public and write a press release, which is accurate, true to scientific data and also find an angle to catch the journalists' interest. Public information officers normally follow a series of steps before the organisation issues a press release.

When a scientist has found an interesting result, the public information officer will, in cooperation with the scientist, create a draft for a press release. A staff scientist is also connected to the public information officer, and helps the public information officer with back ground research and determine if the work has been done before. The staff scientist will correct the press release and will afterwards return it to the public information officer, who will again go through it with the scientist. When possible errors are corrected, the press release will be send to a review board, who will either accept or decline the press release (Madsen, 2005). When the review board has accepted a press release it is ready to be announced. This is the general process of organizations, but the process may differ from organization to organization. Most press releases targets the journalists, but a minority of the organizations, as e.g. ESO, announces two press releases, one targeting science journalists and one targeting the public.

3.1.4 The Work of Journalists

There are, in science communication, two different kinds of journalists, science journalists and general journalists. Mostly science journalists are general journalists, who have got an interest in science and in a number of years have taught themselves. Very few science journalists are former scientists (Gregory & Miller, 1998, p. 109).

However, according to Schilling, *"the difference between a general journalist and a science journalist is that the general journalist do not have the contacts and do not know who to call"*, the trustful connection between public information officers and journalists mean that normal journalists often use public information officers as an uncritical source (Madsen, 2003).

The journalist may want help from the scientist in order to understand, articulate and make the journalists work accurate. The journalist has a difficult job in communicating rather complicated science to the public and this can become most successful with the help from scientists. There is therefore at times a contact between the journalists and the scientist. Even for the best journalists a press release cannot substitute the contact with the scientist (Siegfried & Witze, 2005).

3.2 Factors Affecting Visibility in the Media

Naturally, all scientific findings are not of equal scientific significance and the public information officer may therefore e.g. choose different levels of communication efforts to emphasize the finding and thereby *persuade* the media to run the story. The communication efforts, by which the communicator chooses to communicate science news with, may have great influence on the news coverage of the story. As an example, posting science news only on the website of the public information officer's institution, does most likely not receive as much attention as a live televised press conference.

We found that the visibility ("boosting") of a scientific result can be increased as a result of:

1. Level of communication efforts
2. Level of science importance
3. Use of language
4. Timing

The factors above are an important key when analysing and discussing the problems of hype, which will be done in the following chapters.

3.2.1 Level of Communication Efforts

One may describe the level of effort with which science news may be disseminated, by a **Press Release Visibility Scale** (Christensen, 2006). When releasing a given result, an organisation will choose a level of effort according to the importance the given result. NASA's guidelines and practices for media efforts follow a similar scale (Space Telescope Science Institute, 2005; Watzke & Arcand, 2005). The scale consists of seven steps starting at magnitude 7 being the highest level of effort an organization can put into communicating a result (details below):

- Magnitude 7: Live televised press conference with presence or statements from a high ranking political figure e.g. a head of state or a president.
- Magnitude 6: Live televised press conference.
- Magnitude 5: Press conference.
- Magnitude 4: Media teleconference.
- Magnitude 3: Press release.
- Magnitude 2: Photo release.
- Magnitude 1: Web-only posting.

Magnitude 7, live televised press conference with presence or statements from political front figure, is the highest communication effort you may put in a press release for major scientific discoveries. As an example, when (NASA, 1996) announced they had found *"evidence that strongly suggests primitive life may have existed on Mars"*, President Bill Clinton later the same day stated, that *"if this discovery is confirmed, it will surely be one of the most stunning insights into our universe that science has ever uncovered"* (The White House, 1996). Only major scientific discoveries are endorsed by politicians, hence the media gets even more attracted by the story. Normally the news will be based on an accepted peer reviewed paper to be published in a prominent science journal like e.g. Science or Nature.

Magnitude 6, live televised press conference, stresses to the journalists that the scientific institution believes the scientific finding is of major importance, due to the efforts on a live televised press conference. The fact that the press conference is broadcasted live on e.g. NASA TV further stresses the major importance of the scientific finding.

Magnitude 5, press conferences, that are not televised live are most likely to receive less attention than their live televised counterpart, mainly because a live event will need the journalists to gather in persons in one particular geographical location. As with the lived televised press conferences, the science news will normally be based on a paper to be published in a prominent science journal, exceptions are press conferences and scientific conferences.

Magnitude 4, media teleconference, is where science news representing major scientific discoveries may be communicated at teleconferences where journalists may phone into a scientific institution. At the teleconference, a scientist is giving a presentation and the journalists may ask questions afterwards. The media teleconference allows the journalist to get in immediate contact with the scientist. The news is, as with the press conferences, also based on an accepted peer reviewed paper, that most times is going to be published in a prominent science journal.

Magnitude 3, press releases, is the most used way of communicating science news, which represents a scientific discovery that is of significant importance to the general public. The press releases are sent out via distribution lists, which cover hundreds of journalists and news media. The journalists are however flooded with press releases everyday that all competes to get page space, which makes it important that the press releases catch the attention of the journalists in the headline. If a **wire service** picks up a press release, it is normally printed in many local newspapers. Normally there exists an accepted peer reviewed paper to be published in some journal.

Magnitude 2, photo releases, usually does not represent major scientific discoveries, but e.g. contain aesthetic images. Even though the scientific content is relatively low, a photo release of e.g. Mars may still achieve considerable media attention, and appear on the front page of New York Times (Levay, 2005). Consequently, photo releases may get more attention that live televised press conferences, even though of the lack of a scientific finding. There is most likely not a scientific paper serving as background for the release.

Magnitude 1, web stories, posted only on the scientific institutions websites, contains less interesting news or information from the scientific institution that only is interesting for visitors of the website of people with greater interest. The news is mostly of technical or political nature, such as signing of agreements, openings of new telescopes etc. A key point is that the end user needs to be active to receive the message, by e.g. browsing the scientific institution's website. This is contrary to the other magnitudes, which pushes the message towards the end user.

It is important to note, that the Press Release Magnitude Scale only describes the level, by which the public information officer can choose to emphasize a given press release, and not the *level of attention* the given press release will achieve in the media. The level of communication efforts and the level of media attention are however closely related but nevertheless not in a one to one relationship. As mentioned above, a beautiful image of Mars may in some cases get just as much attention in the general public, as live televised press conference on e.g. more technical findings.

The number of images/animations in the press packages of press releases together with whether the given news is **embargoed** or not, can to a minor degree affect the visibility. Science news will not be broadcasted on television unless the news is released with video clips. However, the size of the press package tends to grow as you climb the Press Release Magnitude Scale (Christensen, 2006).

3.2.2 Level of Science Importance

As mentioned, not all discoveries are of equal scientific importance. Nevertheless the level of science importance is an important factor that affects visibility, since e.g. discovery of life beyond Earth most likely would achieve worldwide media attention compared to the discovery of some element in the atmosphere of a star.

An important point, when discussing the level of science importance, is that this factor is important for the *visibility* of a science result, but does not affect the *credibility* of the communication much. Meaning largely that, either a scientific discovery is interesting and of great importance or not. This does however not mean that the discovery may be based on tentative findings, and the public information officers therefore risk choosing too high a level of communication effort.

3.2.3 Use of language

Simplification and analogies are often used in the process of making a press release easy understandable to the general public. However, the wording can be used to overstate claims and thus increase visibility of a scientific finding. This is mostly done by attachment of a large number of superlatives like ‘biggest’, ‘fastest’, ‘first’ and omitting cautionary words like ‘may’, ‘could’ and ‘possible’. According to Livio (2005), *“when using words like “may”, “could”, “possible” etc. the news media does not find these stories to be exciting enough, and does therefore not print them [...]”*.

Superlatives are added to catch the attention of the journalists. Since the general journalists works under heavy time pressure and deadlines, they often only have time to read the headline of a press release. Furthermore, if the headline of press release has caught the attention of general journalists, they are often too busy to do background checks (Lorenzen, 2005; Schilling, 2005). Hence, the press release must be interesting and easy understandable, since if the journalist finds interest in it, then there is a good possibility that the general public will as well (Siegfried & Witze, 2005).

3.2.4 Timing

Timing is another factor, which can determine *when* a press release is announced by an organization. It can be an advantage to release news about e.g. Moon if it for example is the anniversary of the Moon landing, while this will make the journalist more prone to print news about the subject. Another form of timing is when the announcement of a press release is just before the Congress is voting for funding. Some journalists are aware of this as Fosbury points out *"when a professional in, I guess, any science sees a press release they think the organization must have a grant application review coming up and therefore they are trying to create some kind of event around this"*.

4 Case Study: The NASA 1998 Extrasolar Planet[6]

> *"In hindsight the NASA 1998 exoplanet press release was too strong and too confident, but because it was published at a NASA Space Science Update, everybody believed it"* – Govert Schilling.

One example, which is often quoted being a failure in terms of credibility by the different communication actors, is the case of the NASA 1998 Extrasolar Planet (Livio, 2005). In the introduction two other examples have been mentioned which also contains examples of many possible conflicts and credibility problems. Common to all examples, also those not presented in this report, is the opaqueness of the cause of the problems: where the problems lie or even if an actual problem exists. Many factors contribute to opaqueness of the cause, e.g. large pressure and great competition with other media or institutions.

The case we presents in this chapter, contains many examples of somewhat clearer potential conflicts and can therefore shed light on the factors affecting visibility, as described in Section 3.2, before we move on to analysis of our interviews.

4.1 The Story

On 28th May 1998 NASA unveiled what was believed to be the first direct image of a planet outside our own solar system (Space Telescope Science Institute, 1998a), a so-called extrasolar planet. The image showed a newly formed binary star system that seemed to be connected to another object at the end of a strange filament, suggesting that the object had been flung away from the binary star system (see Figure 4.1).

The news was unveiled at a NASA Space Science Update, which is a live televised press conference broadcasted on NASA's own TV channel, NASA TV. Dr. Susan Terebey from the Extrasolar Research Corporation in California led the team who made the discovery. Due to the NASA TV exposure the story appeared on national television in the USA (Space Telescope Science Institute, 2000).

In mid 1999 there were rumours that Terebey had found that the protoplanet most likely was background star, but that she wanted to wait for her paper to be published before announcing it (Cowen, 1999). On 6th April 2000 NASA issued a press release with the headline: *"Suspected Protoplanet May Really Be a Distant Star"* (Space Telescope Science Institute, 2000). A timeline for the events is given in Appendix A.

[6] As mentioned in Preface, it is very important for us to state, that this example has not been chosen to criticize a special institution, communicator or scientist.

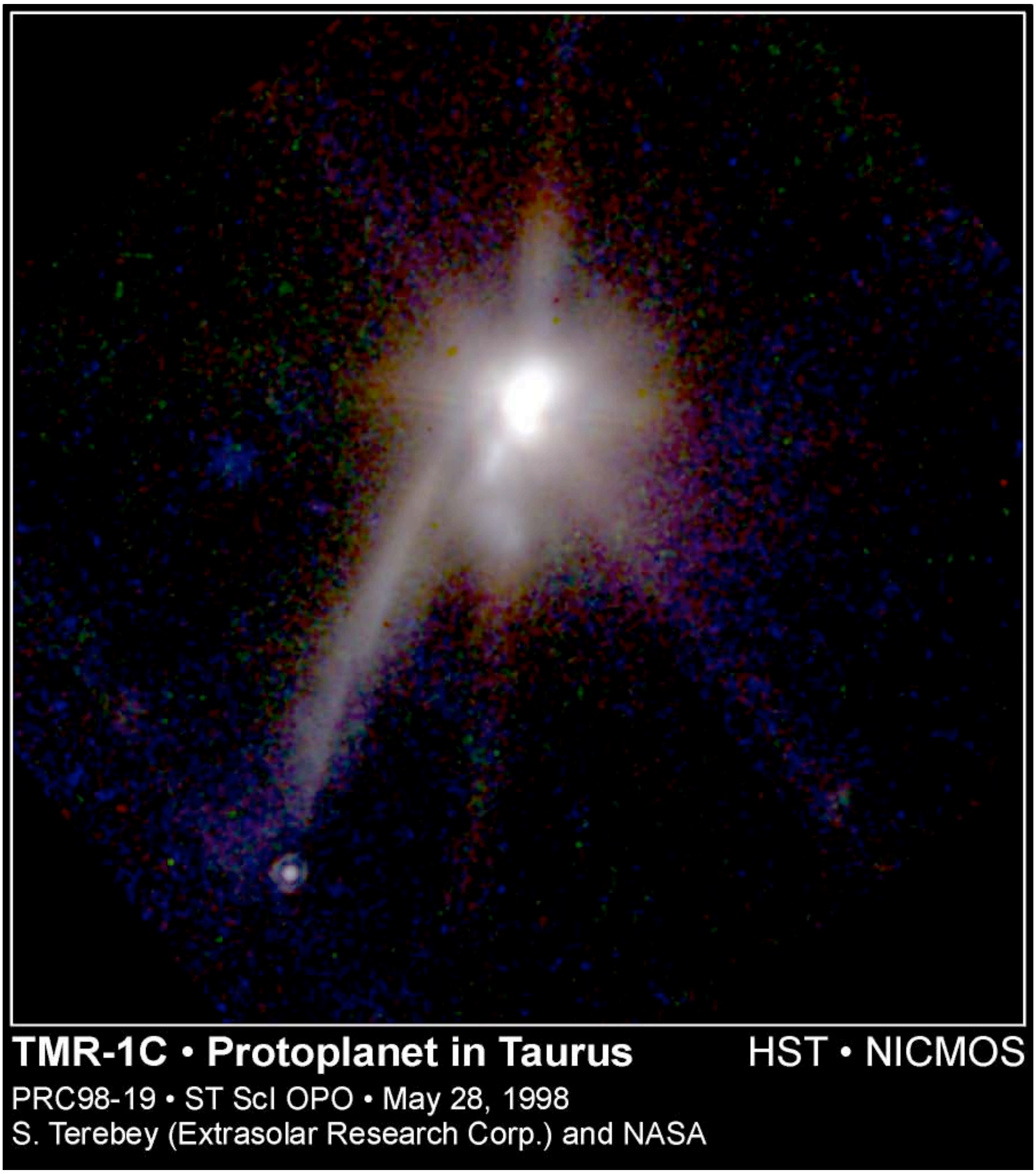


Figure 4.1 *Image of believed exoplanet (note the title of the picture print layout below the image which says 'protoplanet') – Credit: S. Terebey (Extrasolar Research Corp.) and NASA.*

4.2 Possible Credibility Issues

The potential credibility problems with this example, as indicated by the interviewees, are that too high a level of communication efforts were used (Schilling, 2005), because the results were based on tentative findings and no paper backing the news at the time of the release (Tyson, 2005).

Although it is difficult to analyse the exact reasons for this notion to arise in the science communication community we can try to examine the example in slightly more detail to find indications where the problems may have occurred.

The analysis of this case study builds on the factors affecting the visibility we identified in Section 3.2. The crucial question in each case is naturally whether the visibility has been increased so much that the **hype-threshold** (Christensen, 2006) has been crossed.

4.2.1 Level of Science Importance

The level of science importance was quite high, since the image was the first direct look (in visible light) at an extrasolar planet. Previous methods had e.g. detected extrasolar planets by a decrease in light from the star when the planet passes by the star in its orbit.

However, the science results was based on tentative findings and as Terebey states in the conclusion of the paper (Terebey *et al.*, 1998): *"There are two key experiments to test the idea that TMR-1C is an ejected protoplanet. Spectra [...] to better discriminate between stellar, brown dwarf, or planet origin. [...] proper motion measurements will detect TMR-1C's motion on the sky."*

The paper backing the press release was first submitted one month later and then accepted in August (see Appendix A).

4.2.2 Use of Language

The press release headline said: "Hubble Takes First Image of a Possible Planet around Another Star and Finds a Runaway World". The use of the qualifier 'Possible' is naturally important and shows some intention in keeping the overstated language at a low level. The content of the press release also use lots of cautionary words, however you also find sentences like: *"Hubble researchers estimate the odds at two percent that the object is instead a background star"* (Space Telescope Science Institute, 1998a).

4.2.3 Level of Communication Efforts

The story was promoted as a magnitude 6 on the Press Release Visibility Scale (Christensen, 2006). At the live televised press conference, it was made clear that it was preliminary results, and that further investigations were need to confirm the hypothesis (Space Telescope Science Institute, 1998b). The news was broadcasted worldwide as a sensation.

Nevertheless, since the level of the science importance was high the chosen communication efforts made sure the news got worldwide media coverage. According to Schilling, *"In hindsight the NASA 1998 exoplanet press release was too strong and too confident, but because it was published at a NASA Space Science Update, everybody believed it"*.

4.2.4 Timing

The release date could indicate that the organisation announced the finding with reference to the annual **AAS meetings**. The press release was announced on the 28th May, and the following AAS meeting was on the 7th of June, which meant that the visibility was increased when also presented later on the AAS meeting.

4.2.5 Credibility of the Press Release

In summary, it is clear that there were some components of this example that showed an intention to make credible science communication. There are however several instances where the communicated story crosses the *hype-threshold* and turns into to hype. In hindsight, it seems like the level of communication efforts was too intense, since the scientific results were based on tentative findings.

The results were presented worldwide, but according to Edmonds, not much of the mistake got out to the public, and the case has therefore had minimal effect on loss of credibility in the general public. However, Livio states, *"the one event which is always quoted, being a failure in terms of credibility, is the NASA 1998 Extrasolar Planet"*. This indicates that the mistake did pose a problem in the scientific community, since people remember the story. Furthermore Terebey was heavily criticised by her peers, no matter that she according to Schilling *"did everything right, she had a paper, a press release, and later a accepted peer reviewed paper and she published a new press release when it was proven wrong"*.

NASA did however put out a new press release when the results were proven wrong and as Livio states, *"you can not avoid that something is proven wrong later – it is the way science progresses"*.

5 Analysis

"Behind hype is the problem of visibility and recognition – the fight of organisations, laboratories or people for money" – André Heck.

5.1 Definition of Credibility and Hype in Science Communication

Our first research question was: How do communication actors define credibility and hype in science communication?

All our interviewees, regardless of whether they were a scientist, science communicator or journalist, agreed on the view that it is very important to keep their credibility (however defined) and that credibility is something you need to earn every day. Furthermore, they generally agreed on that credibility is something that is very easy to lose, and according to Villard, *"once [...] lost it is very hard to achieve again"*.

Eleven out of twelve of the interviewees largely defined credibility in science communication as being honest and doing your homework well. Interestingly, hype was generally defined as taking credit for more than you deserve by overstating importance of science results e.g. by *increasing visibility overly*. Hence, the word hype is more or less used in lack of a proper word for not being credible. This means that credibility and hype actually is two sides of the same question, and thus cannot be discussed separately. The NASA 1998 Extrasolar Planet (see Chapter 4) is an example of where NASA possible used too high a level of communication efforts and thus increased the visibility overly.

However, as we shall analyse in the following sections of this chapter, the interviewees did not have the same perception of when the hype-threshold was crossed.

5.1.1 Alternative Definition of Credibility

Heck, as the only one, defined credibility quite differently than the other interviewees. Heck stated, *"credibility occurs if the message that you conveyed has been received credible by the receiver"*. As a result, Heck points out that your message might be wrong and inaccurate, but if it is received credible by e.g. the general public then you are credible. Furthermore this implies that as a communicator, as Heck stated, *"you are largely responsible to tailor your message in a way it is well received"*.

5.2 The Fight for Visibility

Our second research question was: In which situations does the communication actors experience hype?

According to our interviewees, hype has become an everyday event and as stated by Schilling, *"there is hype everywhere and everybody is doing it"*. The interviewees generally agreed on the view that a certain amount of hype is a necessity for reaching the general public and thus that the fight for visibility is largely the reason for hype. They pointed towards the following situations as to how the fight for visibility is experienced:

- Catching the media's attention
- The competition for funding
- The strive for recognition

5.2.1 Catching the Media's Attention

The following statement from Hurt does brilliantly in summoning up the dilemma when trying to catch the media's attention: *"In public affairs you are pulled between two poles, sensationalizing the results and correctness."*

About the only way to achieve large-scale visibility in the general public is by catching the attention of the mass media. However, according to Madsen, *"getting into the public mass media is not simply a question of the quality or merit of the 'news' itself – it is a question of understanding and mastering the 'news game' in a climate dominated by harsh competition with less ethical stops than we would sometimes wish"*.

All our interviewees agreed about the need for high accuracy when communicating to the general public, on the other hand as Villard stated, *"[...] the level of accuracy is irrelevant if no one pays attention"*. As a result, it is necessary for the public information officer to make science results sensational and understandable for the general public by simplifications and analogies, as described in Section 3.2.3. However, some of our interviewees pointed towards that it is easy to introduce errors in process of simplification when trying to increase the visibility. Furthermore increasing the visibility overly by use of language, sometimes, according to Livio, *"[...] results in press releases that have a very slim chance of being interpreted right"*.

Lastly, as most journalists also have a tendency to favour the most interesting press releases, this also becomes a factor in the promotion of hype (Cirou, 2005). Schilling emphasizes this by stating that *"...every serious science journalist knows that press releases are made by public information officers who emphasize their own organization "*.

5.2.2 The Competition for Funding

The fight for visibility is intensified, especially in the United States of America where the organisations and scientists has realised the need for communicating to the general public who pays for their research (Lorenzen, 2005; Tyson, 2005). This point of view is supported by Schilling who states that *"the more the people from the government see your work, the more they can relate to it, and the more money they will provide to the organization"*, thus more visibility largely means more money for research.

As a result, scientists can no longer hide and the increasing competition in the scientific community can push the scientist to overstate their results in order to obtain visibility and thereby more funding (Leibundgut, 2005) – according to (Rees, 2001) *"scientists themselves are now prone to hype up their contributions [...]"*. The interviewees who were public information officers or science journalists, also pointed towards that *"the general trend is that the better and the younger scientists are, the more willing they are to communicate"*, as stated by Lorenzen. Hence, our findings suggest that communicating to the general public and the hype may be attached, in an increasing way is becoming a criterion for success in the scientific community.

5.2.3 The Strive for Recognition

Parallel to the competition for funding, our interviewees indicated that there are also many scientists, laboratories and institutions in the scientific community who strive for recognition by their peers and in the general public (Heck, 2005). To be the first to discover e.g. a new planet in the Solar System or a direct visible light image of an extrasolar planet gives the scientist, laboratory and institution who made the discovery a lot recognition – at first by their peers, but perhaps later also in the general public.

The strive for recognition means that scientists in order to the first to be credited for their discovery, may be tempted to overstate their results or publish results based on tentative findings because of competition from other groups. However, the scientists' institutions may also push them to overstate their results by e.g. using too high a level of communication efforts, because the institution also may strive for recognition. According to our interviewees, areas with greater competition are more prone to hype than areas with less competition. As an example, the great competition in the search for extrasolar planets is partly because the search is directly linked with the question of life beyond Earth (Madsen, 2005).

5.2.4 Balancing Hype

Hype in science communication seems mostly to be at a reasonable and acceptable level. The general journalists usually have to trust press releases from the public information officers due to heavy time pressure and deadlines, whereas science journalists tend have more time for background research on the their stories.

As a result, most science journalists are aware that public information officers will emphasize their own institution in press release and try to make the journalist have a special view on a case. However, according to Lorenzen it is still *"the responsibility of the journalist to check the press releases"* to keep their own credibility, but the other hand Lorenzen also states *"[...] people who lie are dead to me and to my colleagues too"*. Consequently these two quotes emphasize a point from all of our interviewees that, mutual respect is a factor in balancing hype at a reasonable level. If the mutual respect is lost, then you have lost your collaborators.

5.3 Benefits and Drawbacks of Hype

Our third research question was: How do the communication actors experience the consequences of hype?

Our interviewees identified both some benefits and drawbacks of hype.

5.3.1 Benefits of Hype

Hype may help to break the nearly impenetrable wall of noise from the commercial players on the communication market, as described in Section 5.2, and according to Hurt, *"hype has been beneficial to the scientific community, because reporters need to know why this [research] is interesting to their readers"*. In effect this should be considered beneficial, as it may increase the public awareness of science and according to Schilling make the general public's view on science *"[...] less dull, because the exciting subjects are often being hyped"*. In the last end, this may result in more funding for research, more science students and increased public understanding of science.

However, according to Villard *"to make something interesting and glamorous is not hype – hype is when you take credit for more than you deserve"*. Thus, you may argue that it is questionable if you can define it as benefits of hype and not just benefits of good science communication.

Nevertheless, the public information officer according to Watzke *"[...] ends up walking a line, because you want to be as interesting and provocative as possible with out being wrong"*. Hence, the public information officers must constantly struggle to increase the visibility as much as the science news can be credited, but sometimes the public information officers inevitable crosses the line.

5.3.2 Drawbacks of Hype

Our interviewees agreed on, as stated by Villard, that *"if you hype, you will lose credibility"* and losing your credibility largely means that your career is at stake. However, you may lose your credibility towards both to the general public and your collaborators. Our findings nevertheless suggest that it is much easier to lose credibility towards your collaborators than the general public, as indicated by the NASA 1998 Extrasolar Planet case study (see Section 4.2.5).

5.3.3 Scientists' Concern of Accuracy

Scientists fear to lose credibility among their peers and thus fear to lose their recognition in the scientific community. As a result, as stated by Villard, *"scientists can be overly concerned about the accurate reporting of their work due to criticism from their peers. However, regarding the public, no one complains about mistakes being corrected as they see it as a natural part of the scientific process"*. It is nevertheless not only the scientists but also the scientist's institution, which may be overly concerned about accuracy, since they also strive for recognition in the scientific community.

Our interviewees mentioned several ways in which the scientists or scientific institutions may be overly concerned for accuracy:

- Exaggeration of scientific findings.
- Lack of mentioning of other scientists' work.
- Comparing with other facilities.

However where many scientists try to stay modest when they publish their results, the public information officers and journalists know that catching headlines and simplifications are necessary in order to get the attention of public. Among the scientists it has been a common notion that reporting on science is inaccurate and hype news. This conception has nevertheless been proven false by (Shaefer *et al.*, 1999), when they investigated the accuracy of three astronomical topics published in US newspapers. This result is also supported by (Madsen, 2003) in his study of European newspapers.

5.3.4 Losing Credibility with Collaborators

Consequently, if the scientist is of the conception that the public information officer is hyping the results, the scientists will most likely be less willing to cooperate (Leibundgut, 2005). At the most extreme extent, public information officers who use too much hype, will lose their source of information in form of the scientist. It is therefore important, according to Watzke, *"[...] not [to] do anything without the scientist's agreement, even* *though we might strongly disagree with their ideas of about how to represent their result to the public".*

However, according to Fosbury, *"it's [...] a problem that the science community do not understand the work of communicators"*, which is further emphasized by Villard who states, that *"the scientist does not understand what the public comprehend and find interesting, and needs to accept what the public affairs professionals bring to the table".*

Another problem is that many scientists do not want to publish as *fast* as the science communicators or the institution wish to. This can, as mentioned, be due to reactions of their peers and sometimes it is caused by a wish to maintain scientific standards and norms in the communication process (Schilling, 2005; Villard, 2005). Furthermore researchers success is still measured in the number of refereed papers, grants etc. (Robson, 2005).

5.4 Announcing Science News

Our fourth research question was: When should science communicators go public with scientific results?

The quote below from the session 'Science versus News: On the Cutting Edge' from AAS Meeting #193 (Kinney *et al.*, 1999), illustrates the central problem, as indicated by our interviewees, of when to go public with science results.

> *"Published too soon, science is called 'hype'; published too late, it is no longer 'news'".*

5.4.1 Extraordinary Claims Require Extraordinary Evidence

Our interviewees had quite different opinions of whether a peer-reviewed paper is needed before going public with science results to ensure that accuracy. They generally pointed towards that the peer-review process is quite slow compared to the media, and does therefore not match the way journalists usually work. Journalists do not have time to wait for news to pass through peer-review. On the other hand peer-review is the way for scientists to keep their credibility within the scientific community.

Not all scientific findings are extraordinary claims and thus some findings do not need refereed paper in advance of public dissemination as the consequences of being wrong is limited. As stated by Leibundgut, *"whether a press release needs a paper depends highly on how complex the science is – whether it is 'on/off' or a 'complex technical' result".* Hence, the need for a scientific paper backing a press release increases as the claims becomes higher. As Carl Sagan said, *"extraordinary claims require extraordinary evidence"* (NOVA, 2005).

5.4.2 Extraordinary Claims and Importance of Science Results

Tyson believes that peer-review is essential for increasing the credibility of a given press release and states *"there is nothing wrong in being wrong, but you do not want a press release coming out in advance of a peer reviewed publication of an article – then you are breaking scientific protocol"*. However as Schilling indicates *"peer reviewing and a scientific paper give no guaranties that a press release is solid facts"*. Peer reviewing does not necessarily ensure accuracy, as even though you have an accepted paper, it can still turn out to be wrong – this is how science works (Livio, 2005; Schilling, 2005; Villard, 2005; Watzke, 2005).

Regarding the necessity of peer-review, many of our interviewees expressed their ambiguous opinions towards the process. Villard stated that *"[...] a press release should not always wait for a peer reviewed paper, as some discoveries can be to important to remain secret for long"*. It seems that the time-consuming review process in some cases inhibits the act of communication. Lorenzen agrees with Villard regarding the need to publish fast and stated *"peer reviewing is a slow process – I think you have to communicate fast"*.

5.4.3 Consequences to Scientists when not using a Scientific Paper

However it can be devastating to the scientists if they publish to the public too fast before their paper has been accepted by a journal. According to Tyson, *"if you do not have a scientific paper backing up your press release, it could turn out to be the end of your career - this happened to the scientists involved in the cold fusion"*. Hence, our findings suggest as stated by Villard, *"[...] peer reviewing pleases the scientists, but not the public [...]"* and indicates that peer reviewing is of great importance regarding the maintenance of respect scientists in between.

5.4.4 Backing Press Releases with Scientific Paper

To most communication actors, it appears to be very important that a press release builds on a peer-reviewed paper prior to a press release (also known as the Ingelfinger rule). There are a few occasions when a paper is not needed, and it *depends highly* on how complex the science is (Leibundgut, 2005). As Fosbury states, *"if there is no scientific paper backing a press release there'd better be pretty good reasons and you must be prepared to suffer the consequences"*. Thus, science communicators should take special care of not using too high level of communication efforts for extraordinary claims if no paper is backing the press release. The consequences can be quite large for the involved scientist.

5.4.5 Science Results Turning Wrong

Naturally, science results can turn to be wrong and as Villard states, *"science is a self correcting process, in which you are bound to make mistakes – about half the published papers need some degree of correction"*. This point of view on mistakes regarding publishing of scientific research is shared by Schilling who stated, *"it does not matter if results are proven wrong – this is how science works"*.

Our interviewees agreed that, when the science that a press release is building on turns out wrong, as stated by Lorenzen, *"it pays in the long run to tell about mistakes"*. This does however not mean you should retract a press release unless you have made a terrible mistake. Issuing a new press release with a different hook on the story or posting a note on the particular webpage for the press release is the normal way. According to Madsen, *"a press release is not simply a document which describes results of research; it documents the fact that a research result (often associated with specific claims) has been publicized. In this sense, the data can be wrong, but the press release will still be correct. [...]"*.

5.5 Existence of Credibility Problems

Our fifth research question was: Do the communication actors experience that there exists credibility problems in the science communication today?

When asked directly eleven out of twelve of the interviewees had the general perception that no credibility problem exists in science communication today. The only interviewee who was of the opinion that a problem existed was Heck, who stated *"a credibility problem definitely exists, and it cannot be solved through golden rules"*.

There does not seem to be a credibility problem towards the general public (European Commission, 2005), and there are indeed not many cases like the NASA 1998 Extrasolar Planet compared to the total number of press releases. However, our findings suggest that the community remembers both the larger cases, but to high degree also the smaller cases. It seems like the community is very sensitive towards credibility issues. The following statement from Madsen, to some degree illustrates this point:

"When at the time of the ESOF International Scientific Conference we published the press release about the extrasolar planet in orbit around μ Arae, we made sure to make the journalists aware of fact that this particular press release was based on a submitted, but not yet accepted, paper. The urgency of publishing this release was due to series of external factors, but the scientific paper was in fact accepted shortly thereafter. This did not seem to bother journalists, but later at a press conference in the US we were heavily criticized for this – though indeed not by the journalists!"

However as Schilling points out and thereby decreases the magnitude of the problem by stating, *"there will always be competition between public information officers and public information officers, scientists and scientists and journalists and journalists"*. The journalists *expect* the public information officers to hype their press releases and emphasize their organizations, and it should therefore not be considered a problem (Lorenzen, 2005; Schilling, 2005).

5.5.1 The Need for Guidelines

On the question of whether guidelines are needed to ensure credibility, our interviewees answered quite differently.

- Four interviewees said guidelines would be a good idea.
- Four interviewees said guidelines might/might not be a good idea.
- Four interviewees said guidelines would not work.

The arguments presented pro guidelines were that could set the tone. According to Madsen, *"[...] it would not provide any guarantees, of course, just like the traffic code: It may be violated, but at least it provides a set of rules for everyone to go by"*. Hurt also thinks that some kind of guidelines *"can be helpful for consistency, but they should also reflect the real needs of journalists and be applied flexibly in situations where they can be counterproductive to communicating the story"*.

The arguments presented against guidelines, were that the review process of press releases is already so heavily scrutinized. As stated by Watzke, *"the review process at Chandra is pretty rigorous with up to six or seven scientists reviewing a press release – some of the many steps are necessary but perhaps not all"*.

Another argument why guidelines should not be made is purposed be Schilling, who points out that *"a code of conduct is not a good idea, since there will always be a lot of competition. Scientists and public information officers will always want to beat the other organisations"*. This indicates that even if guidelines were made, the public information officers and organisations would break them in the fight for visibility.

On the other hand, this might be exactly the reason why guidelines are needed, while science communication is rapidly developing and the competition is getting harder and harder. Furthermore asking our interviewees about the need to guidelines can however also seem like asking the speed violators if there should be a speed limit.

6 Discussion

> *"We need a shift in the attitude towards science communication – it is not only a problem of the PR people but also of the scientists."*– Dirk Lorenzen.

Our sixth research question was: How would a recommended Code of Conduct for press releases in astronomy look like?

Even though hype is normally perceived as a harmful act within the scientific community, hype is also a necessity to communicate a technical scientific result to the public. In general the public information officers are balancing hype so that it is not damaging to science. This balance can be a great dilemma to the public information officers, as they constantly need to walk a line to get the news out to the media. If they are too accurate they will not receive media attention, if they announce inaccurate press releases they will lose credibility to the journalists and not get any visibility. The media are used to and expect a certain amount of hype.

When asked, only one of the interviewees claimed that a credibility problem with the science communication of astronomy exists. As presented in the report, there exists only few clear-cut cases of hyped press releases, but those that exist are well known in the community and have been extremely harmful to involved institutions and persons. A general credibility problem may not exist, but the actors all agree that credibility is an *immensely important* topic to discuss while the push from organisations is getting stronger and the competition of visibility is increasing.

6.1 Recommend Code of Conduct for Press Releases

Below we have listed a recommended code of conduct for astronomical press releases that may help to prevent loss of credibility. They constitute a set of recommended guidelines, which may help to minimize hype. Some are directly aimed to ensure scientific accuracy in press releases announced to the public; others are included to ensure credibility within the scientific community, public information officers and scientists.

1. Apply the Ingelfinger rule
2. Get the press release approved by the main scientists
3. Apply institutional refereeing
4. Mention work done by others in the same field
5. Mention the scientific process
6. Include contact info
7. Issue a correction if the science or the press release turns out to be incorrect

8. Honesty pays

6.1.1 Apply the Ingelfinger Rule

The Ingelfinger rule is the principle that scientific results should normally not be published to the public before a scientific paper has been accepted. To most actors it is important that there is a scientific paper backing up a press release, as this is a vital factor in order to ensure scientific accuracy. The need for a refereed scientific paper backing a press release increase as the claims get larger. If no paper is used for large claims the consequences can be quite high. This means that public information officers should take special care before using to high level of communication efforts to release news with no scientific paper. Furthermore chances are that it is the scientists who will suffer the consequences.

As a rule, there should always be an accepted scientific paper backing up a press release. If this for some reason is not the case, it should be indicated in a distinctive way to allow the reader to evaluate the credibility of the presented results.

6.1.2 Get the Press Release Approved by the Main Scientists

Interviewees mentioned that the scientists' lack of willingness to communicate was due to the fear of losing credibility to their peers. A way to improve the scientists view on the communication of press releases is to make the scientists collaborate as much as possible and understand the needs when communication to the public. Furthermore always be sure that the scientist approves a press release, so he agrees with the content. In this way the scientists might be more comfortable with their scientific results being communicated.

6.1.3 Apply Institutional Refereeing

In most organisations the press release also needs to be accepted by an internal refereeing board, which ensures that science is communicated accurately. When run through an internal refereeing board before release, some factors that are known to increase inaccuracy can be eliminated. This means that there is less risk of oversimplified results, incorrect analogies and other factors that can harm the credibility. The internal refereeing also helps the scientists maintain their credibility to their peers, which, as mentioned above, is important for the scientist's willingness to communicate.

6.1.4 Mention Work Done by Others in the Same Field

Public information officers have a very restricted amount of space to communicate often very complex findings. Therefore the work done by other scientists or even the names of other authors are often not mentioned in a press release. Even though this might seem irrelevant to the public information officer it is important to remember that scientists have generally spend a huge amount of time on their research and it is only natural if they get offended if other scientists or organizations get the reward for their work. Therefore if at all possible the public information officers should mention the names of the authors and also possibly prior important work on the subject.

6.1.5 Mention the Scientific Process

If at all possible a press release should also mention the scientific method, or work process (see Section 3.1.2). The public needs to understand how science progresses, in order to distinguish between mistakes as a result of hype, and mistakes in terms of the natural development of science. Several of our interviewees pointed out that mistakes are bound to happen, as the progress of science in most cases will result in a modification or substitution of current knowledge.

6.1.6 Issue a Correction if the Science or the Press Release Turns Out to be Incorrect

Press releases made on science that is later proven wrong should as a minimum bear an indication on the web version that this is the case, and possibly warrants a correction of the press release with a new view on the story. Only press releases containing large mistakes should be retracted completely. These guidelines will aid the journalist in getting the overview of whether a theory is still standing or if it has been proven wrong.

6.1.7 Honesty Pays

If you are honest, people will respect you and they will trust your work. As many of our interviewees pointed out there is nothing wrong in making genuine mistakes as long as the scientific protocol has been followed and the public information officers are not trying to hide mistakes.

7 Conclusion

Our study suggests that the fight for visibility in the media is the main cause of hype. The public information officers need to use some degree of hype to obtain visibility in the media, and are also expected to use hype by the media. However, while hype to some degree can be beneficial when communicating a technical scientific message, excessive use will lead to loss of credibility and can have devastating consequences for the involved communication actors.

A credibility problem in astronomy does not seem to exist towards the public. However, it is different within the scientific community, where the communication actors remember the cases of "bad science communication". Our findings suggest that the problem of credibility, if any, lies internally within the scientific community of astronomy and is mainly caused by the lack of understanding of each other's worlds. Furthermore it is clear that scientists, public information officers and journalists all have different views on when to scientific results should be communicated to the general public.

Problems uncovered in the analysis have been used to prepare a recommended code of conduct for astronomical press releases (see Section 6.1). The code of conduct presents guidelines determining how to control factors that can influence hype.

During this exploratory study it also became clear that there is a great interest in and concern for credibility among the communication actors. It is a topic that everyone knows is very sensitive and is of high priority to all involved communication actors. It is our impression, that large efforts are put into producing as accurate and credible science communication as possible.

Glossary

American Astronomical Society (AAS) – Major organization of professional astronomers in North America established in 1899. The basic objective of the AAS is to promote the advancement of astronomy and closely related branches of science. The membership (~6,500) also includes physicists, mathematicians, geologists, engineers and others whose research interests lie within the broad spectrum of subjects now comprising contemporary astronomy.

AAS Meetings – AAS meetings take place twice each year and are dynamic gatherings of professional astronomers from around the world. The meetings are filled with scientific sessions, both poster and oral, as well as invited sessions from prominent researchers with exciting result (see also *American Astronomical Society*).

ALH84001 – Mars meteorite suspected of containing fossil evidence for microorganisms. Announced by NASA in August 1996 (NASA, 1996), followed up by statements from President Bill Clinton (The White House, 1996) and article in Science (McKay & Gibson, 1996). However, by 2005 most experts agree that the microfossils are not indicative of life, but of contamination from earth (Kerr, 1996).

Astro-ph – A fully automated e-print archive for astrophysics preprints. Most scientific papers in astronomy and astrophysics are published on this mailing list before the paper has been peer reviewed and published in a journal. The service may be accessed at http://xxx.lanl.gov/archive/astro-ph.

Carl Sagan – Carl Sagan has played a leading role in the American space programme since its inception. He has been a consultant and adviser to NASA since the 1950s, briefed the Apollo astronauts before their flights to the moon, and was an experimenter on Voyager, Mariner, Viking and Galileos expeditions to the planets. He helped solve the mysteries of the high temperature of Venus (a massive greenhouse effect), the seasonal changes on Mars (windblown dust) and the reddish haze of Titan (complex organic molecules).

Chandra X-Ray Observatory – The Chandra X-ray Observatory is part of NASA's "Great Observatories" along with the *Hubble Space Telescope*, the *Spitzer Space Telescope* and the now deorbited Compton Gamma Ray Observatory. The Chandra X-ray Observatory program is managed by NASA's Marshall Center for the Science Mission Directorate, NASA Headquarters, Washington, D.C.
The Smithsonian Astrophysical Observatory (SAO) in Cambridge, Massachusetts, is responsible for the conduct of the day-to-day flight operations and science activities from the Operations Control Center

Close-ended interview – Opposite of *open-ended interview*. A form of interviewing where the interviewees have a fixed number of answering choices e.g. yes/no questions.

European Space Agency (ESA) – ESA is a space agency with approximately 1900 employees and 17 Member States, whom all contribute financially to its operations. ESA's 17 Member States are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. Canada, Hungary and the Czech Republic also participate in some projects under cooperation agreements. ESA has a council which consists of one representative per memberstate, and functions as the governing body. The Agency's projects are designed to find out more about the Earth, its immediate space environment, the solar system and the Universe, as well as to develop satellite-based technologies and services, and to promote European industries. ESA also works closely with space organisations outside Europe.

European Southern Observatory (ESO) – European Organisation for Astronomy in the Southern Hemisphere and a member of the EIROforum, the partnership of European, intergovernmental research organisations (together with CERN, EFDA-JET, EMBL, ESA, ESRF and ILL).

Embargo - An agreement that a news organization refrains from reporting the embargoed material to the public until a specified date and time, in exchange for advance access to the information.

Extrasolar planet – A planet located outside our Solar System.

Hubble Space Telescope (HST) – The Hubble Space Telescope is part of NASA's "Great Observatories" along with the *Chandra X-ray Observatory*, the *Spitzer Space Telescope* and the now deorbited Compton Gamma Ray Observatory. It weights about 11 ton, is about 13 meters long and is currently being managed by *STScI*. It is an optical space telescope which has been deployed in space since 15th April 1990.

Hype-threshold – The upper limit for when hype instead of only increasing the visibility also affects the credibility negatively.

Mars Meteorite – See *ALH84001*.

National Aeronautics & Space Administration (NASA) – Organisation which efforts are directed toward the transformation of the United states of Americas air transportation system, and developing the knowledge, tools, and technologies to support future air and space vehicles.

NASA Space Science Update (SSU) – see *NASA Science Update*.

NASA Science Update (NSU) – Televised press conferences that are held at NASA. The goal for NSUs is largely for

TV coverage as well as high-profile articles. Formerly know as NASA Space Science Update (SSU).

Open-ended interview – Opposite of *close-ended interview*. A form of interviewing where the interviewees not are being limited to a determined set of answers.

Press Release Magnitude Scale – A scale that describes the different levels of communicating efforts that a science communicator may use to emphasize the importance of a scientific finding to thereby persuade the media to run the story.

Qualitative research – A way to collect data based on a long and thorough examination of the given subject (e.g. interviews).

Quantitative research – A way to collect data based on a superficial examination of the given subject, however done in a high quantity. This form of data is mostly used for representative statistics (e.g. questionnaires).

Research question – A sub-question, used in qualitative research and shaped to shed light on a given aspect of our main question.

Space Telescope Science Institute (STScI) – A sub-section of NASA responsible for operations done with Hubble Space Telescope.

Spitzer Science Center (SSC) – see *Spitzer Space Telescope*.

Spitzer Space Telescope – The Spitzer Space Telescope (formerly SIRTF, the Space Infrared Telescope Facility) has been deployed in space since the 25th August 2003, and is part of NASA's "Great Observatories" along with the *Chandra X-ray Observatory*, the *Hubble Space Telescope* and the now deorbited Compton Gamma Ray Observatory. It is currently being managed by *SSC*.

Wire Services – News agencies that supply newspapers, magazines, radio and television broadcasters with news, like e.g. Reuters and Associated Press.

References

Brier, S. (2002). *Fra Fakta til Fikta: Videnskabsformidling og populærvidenskab i underholdningens tidsalder*. Copenhagen, Akademisk Forlag A/S.

Christensen, L. L. (2006). *The Hands-On Guide to Science Communication*. New York, Springer.

Cirou, A. (2005). Astronomy Multimedia Public Outreach in France and Beyond, in *Organizations and Strategies in Astronomy*. Ed. A. Heck. Dordrecht, Springer. **6:** 311-320.

Cowen, R. (1999). Image of a Planet: Too Hot to be True? *Sci. News*. **155**(26): 404.

Dumlao, R. & Duke, S. (2003). The Web and E-Mail in Science Communication. *Sci Commun* **24**(3): 283-308.

European Commission (2005). Eurobarometer 63.1 "Europeans, Science & Technology".

Gregory, J. & Miller, S. (1998). *Science In Public: Communication, Culture, and Credibility*. Cambridge, Massachusetts, Basic Books.

Heck, A. (2000). Communicating Astronomy, in *Organizations and Strategies in Astronomy*. Ed. A. Heck. Dordrecht, Kulwer Acad. Publ. **1:** 165-184.

Heck, A. (2005). Personal Communication. Boston.

Jeffs, W. (2004). Study May Cast Doubt On Some 1996 Evidence of Past Life On Mars. Retrieved 4th December, 2005, from http://www.nasa.gov/centers/johnson/news/releases/2004/J04-025.html.

Kerr, R. A. (1996). Martian rocks tell divergent stories. *Sci* **274**(5289): 918-920.

Kinney, A. L., French, V., Villard, R. & Maran, S. P. (1999). Science versus News: On the Cutting Edge. Retrieved 18th November, 2005, from http://www.aas.org/publications/baas/v30n4/aas193/287.htm.

Kvale, S. (1996). *Inter Views: An Introduction to qualitative research interviewing*. Thousand Oaks, CA, Sage.

Leibundgut, B. (2005). Personal Communication. Munich.

Levay, Z. G. (2005). Hubble and the Language of Images. In *Communicating Astronomy with the Public 2005: Proceedings From the ESO/ESA/IAU Conference 14-17 June 2005*, eds. I. Robson & L. L. Christensen, pp. 206-214, ESA/Hubble.

Livio, M. (2005). Personal Communication. Baltimore.

Lorenzen, D. H. (2005). Personal Communication. Boston.

Madsen, C. (2003). Astronomy and Space Science in the European Print Media, in *Astronomy Communication*. Ed. A. Heck & C. Madsen. Dordrecht, Kulwer Acad. Publ.**:** 67-120.

Madsen, C. (2005). Personal Communication. Munich.

Mahoney, T. J. (2005). The Role of the Popular Article in Astronomy Communication. In *Communicating Astronomy with the Public 2005: Proceedings From the ESO/ESA/IAU Conference 14-17 June 2005*, eds. I. Robson & L. L. Christensen, pp. 180-191, ESA/Hubble.

McKay, D. S. & Gibson, E. K. (1996). Search for past life on Mars: Possible relic biogenic activity in Martian meteorite ALH84001. *Sci* **273**(5277): 924-931.

NASA (1996). Meteorite Yields Evidence of Primitive Life on Early Mars. Retrieved 14th December, 2005, from ftp://ftp.hq.nasa.gov/pub/pao/pressrel/1996/96-160.txt.

Nelsen, L. (1998). Essays On Science And Society: The Rise of Intellectual Property Protection in The American University. *Sci* **279**(5356): 1460-1461.

NOVA (2005). Interview With Carl Sagan. Retrieved 22th December, 2005, from http://www.pbs.org/wgbh/nova/aliens/carlsagan.html.

Rees, M. (2001). Science communication and the media. Retrieved 15th December, 2005, from www.pantaneto.co.uk/issue1/rees.htm.

Robson, I. (2005). The IAU Working Group on Communicating Astronomy with The Public. In *Communicating Astronomy with the Public 2005: Proceedings From the ESO/ESA/IAU Conference 14-17 June 2005*, eds. I. Robson & L. L. Christensen, pp. 10-13, ESA/Hubble.

Schilling, G. (2005). Personal Communication. Boston.

Shaefer, B. E., Hurley, K., Nemiroff, R. J., Branch, D., Perlmutter, S., Schaefer, M. W., Gonsomagno, G. J., Mcsween, H. & Strom, J. (1999). Accuracy of press reports in astronomy. *Bull Amer Astron Soc* **31**(1521).

Siegfried, T. & Witze, A. (2005). Astronomers and the Media: What Reporters Expect, in *Organizations and Strategies in Astronomy*. Ed. A. Heck. Dordrecht, Springer. **6:** 311-320.

Space Telescope Science Institute (1998a). Hubble Takes First Image of a Possible Planet around Another Star and Finds a Runaway World. Retrieved 24th October, 2005, from http://hubblesite.org/newscenter/newsdesk/archive/releases/1998/19/text/.

Space Telescope Science Institute (1998b). SSU Webcast: Hubble Sees Runaway Planet. Retrieved 18th October, 2005, from http://hubblesite.org/newscenter/newsdesk/archive/releases/1998/19/video/c.

Space Telescope Science Institute (2000). Suspected Protoplanet May Really Be a Distant Stars. Retrieved 31st October, 2005, from http://hubblesite.org/newscenter/newsdesk/archive/releases/2000/13/text/.

Space Telescope Science Institute (2005). News & Integrated Release Services. Retrieved 28th November, 2005, from http://outreachoffice.stsci.edu/news/newspolicy.shtml.

Terebey, S., Buren, D. V., Matthews, K. & Padgett, L. (2000). The Spectrum of TMR-1C Is Consistent With a Background Star. *Astron J*(119): 2341-2348.

Terebey, S., Buren, D. V., Padgett, D. L., Hancock, T. & Brundage, M. (1998). A Candidate Protoplanet In The Taurus Star-Forming Region. *Astrophys J*(507): L71-L74.

The White House (1996). Remarks by The President Upon Depature. Retrieved 14th December, 2005, from http://clinton6.nara.gov/1996/08/1996-08-07-remarks-by-president-upon-departure.html.

Toy, J. (2002). The Ingelfinger Rule: Franz Ingelfinger at the New England Journal of Medicine 1967-77. *Sci Ed* **25**(6): 195-198.

Treise, D. & Weigold, M. F. (2002). Advancing Science Communication: A Survey of Science Communicators. *Sci Commun* **23**(3): 310-322.

Tyson, N. (2005). Personal Communication. New York.

Villard, R. (2005). Personal Communication. Baltimore.

Watzke, M. (2005). Personal Communication. Boston.

Watzke, M. & Arcand, K. K. (2005). Communicating Chandra's X-Ray Astronomy to the Press and Public. In *Communicating Astronomy with the Public 2005: Proceedings From the ESO/ESA/IAU Conference 14-17 June 2005*, eds. I. Robson & L. L. Christensen, pp. 72-80, ESA/Hubble.

A Timeline for the NASA 1998 Extrasolar Planet

1997	August	Observations are made with the Hubble Space Telescope
1998	28th May	News released at NASA Space Science Update . Worldwide media coverage of news and criticism from peers in the period following (Cowen, 1999).
	9th July	First paper received by The Astrophysical Journal (Terebey *et al.*, 1998).
	18th August	First paper accepted by The Astrophysical Journal (Terebey *et al.*, 1998).
	30th September	First paper printed by The Astrophysical Journal (Terebey *et al.*, 1998).
1999	June	Rumours in the scientific community that Terebey on a scientific conference have said that the spectrum of the protoplanet is consistent with a background star (Cowen, 1999).
	28th August	Second paper received by Astronomical Journal (Terebey *et al.*, 2000)
2000	25th January	Second paper accepted by Astronomical Journal (Terebey *et al.*, 2000)
	6th April	Press release telling that the protoplanet may be a background star.
	May	Second paper printed by Astronomical Journal (Terebey *et al.*, 2000)

B Summary of Interviews

B.1 Peter Edmonds & Megan Watzke

B.1.1 Short Biography (Edmonds)

Dr. Peter Edmonds is outreach scientist for the Chandra X-ray Observatory advertising the wonderful science done with the Chandra X-ray Observatory. His main research interests are binaries and globular clusters, with an emphasis on Hubble and Chandra observations. He studied science at the University of Sydney as an undergraduate, followed by a Ph.D., also at the University of Sydney, where he studied pulsating stars using the Anglo-Australian Telescope. After losing too many battles with clouds he was keen to change over to space-based observing. He moved to Baltimore, Maryland for a postdoc at the Space Telescope Science Institute, followed by a postdoc at the Harvard-Smithsonian Center for Astrophysics (CfA).

B.1.2 Short Biography (Watzke)

Megan Watzke has been press officer for the Chandra X-ray Observatory, which is one of NASA's "Great Observatories," since 2000. Prior to joining Chandra, Ms. Watzke was a public affairs specialist for the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass. Ms. Watzke earned a masters degree in science journalism from Boston University after graduating from the University of Michigan with a major in astronomy and astrophysics.

B.1.3 Statements from Interview

Watzke: "The review process at Chandra is pretty rigorous with up to six or seven scientists reviewing a press release – some of the many steps are necessary but perhaps not all."

Edmonds: "It is our job as communicators to try to see to that more astronomy and more Chandra get into the press and public consciousness – but that said, Astronomy does tremendously well compared to other physical sciences."

Watzke: "In the perfect world, good science communication is science that is conveyed accurately to the general public in such a way that it is easily accessible and digestible while not losing any of the accuracy of the initial result."

Edmonds: “Good science communication is a compromise – it must remain accurate and interesting at the same time.”

Watzke: “Our press releases mainly target science journalists, who then repackage the content so that the end product can reach as many people as possible – however the general public can always access the press release directly at our website”.

Watzke: “If you want your story to make it into TV, you must have simple punch lines.”

Watzke: “We are not concerned about having a really simplified headline because the targeted media like New York Times, Science and Nature will not misinterpret this headline.”

Edmonds: “As communicators we tell the truth, nothing but the truth, but not necessarily the whole truth.”

Watzke: “As long as you are honest about how shaky or how firm the result is, there is not a problem.”

Edmonds: “It is not embarrassing to put out a correction, because it will mostly be the scientist’s mistake – it is the scientific process.”

Watzke: “If you waited to everyone had iron proof evidence, you could never put a press release out – there is always uncertainty.”

Edmonds: “Scientists get upset if something is oversimplified or if credit is not given to scientists who has done work in the field earlier – but then again we cannot mention everybody.”

Watzke: “Some scientists still prefer just to communicate their science via public journals, but I do not see that very often any more.”

Watzke: “We do not do anything without the scientist’s agreement, even though we might strongly disagree with their ideas of about how to represent their result to the public.”

Edmonds: “Scientists are to some extend concerned about being seen as one who steals the spotlight.”

Watzke: “Scientists are not going to get a new job or more observation-time because we do a press release for them, but there is an acknowledgement of benefits if their work is better known.”

Watzke: “It can be an institutional nightmare to do combined press releases with other observatories because of the rigorous review process of press releases.”

Edmonds: “In spirit the whole community are in it together when communicating to the public, but you also want to see your name.”

Watzke: “If a good science story gets to the public, it benefits everyone in the scientific community.”

Edmonds: “I don't think there's a big credibility problem in science communication today – some scientists are being very careful and maybe too credible.”

Edmonds: “NASA’s 1998 extrasolar planet didn’t really hurt credibility in the general public since not much about the mistake got very far.”

Watzke: “NASA has a reputation as being very pushy and over simplifying”.

Watzke: “Did we have any idea that the Quark-star would not come through in the press as we imagined? No, but maybe we could have guessed.”

Watzke: “The Quark-star was somewhat controversial, but sometimes you must try to walk a line, because if everything has to be proven you cannot do anything.”

Watzke: “You end up walking a line, because you want to be as interesting and provocative as possible with out being wrong.”

Watzke: “The way science is reported is changing rapidly”

Watzke: “Scientists are upset to see a wrong message in the newspaper and complain. But it’s not necessarily our fault.”

Watzke: “A charter from IAU with broad outlines to set the tone would be a good idea.”

B.2 Bob Fosbury

B.2.1 Short Biography

Dr. Bob Fosbury is head of Space Telescope European Coordinating Facility (ST-ECF) in Munich. He is currently chairman of the ESO Astronomy Faculty, the largest group of professional astronomers in Europe (and Chile), and is active in the close liaison between the ESO and ESA science programmes. He has published over two hundred scientific papers on topics ranging from the outer atmospheres of stars, the nature of quasars and active galaxies to the physics of forming galaxies in the most distant reaches of the Universe.

B.2.2 Statements from Interview

"I suppose credibility is a whole spectrum of truth or misinterpretation up to the question of the highest level of importance – a potential paradigm shift or whether one should have a look at this because it is cool."

"I believe there is a demand or a perceived demand for quantity of communication and perhaps less interest in identifying aspects of quality and importance in science communication. By satisfying the continuous demand one can blur the distinction between the important high significance events and the run-of-the-mill ones."

"When a professional in, I guess, any science sees a press release they think the organization must have a grant application review coming up and therefore they are trying to create some kind of event around this."

"To show that your idea is an important element while neglecting other important work is something we have to live with."

"I think it is important to expose the public to a scientist directly without the intermediate PR-professional, but aspects of credibility are more exposed in this direct contact, than in the processed contact."

"There is the whole question of misinterpretation of observations and discoveries. There are shades of correctness or credibility in misinterpretations. Necessarily mistakes will be made – if they are genuine honest ones, its fine."

"If one can get that idea of methodology over to the public I think one is doing science a tremendous service."

“If the public feel they are deliberately being misled, then I think their patience will run out.”

“The public could easily remove itself from science as an intellectual activity. Technology is a different thing, but the public do not realise how closely coupled they are.”

“It is difficult to determine what good science communication is when dealing with the general public. I think it is important to have a metrics to see the impact we have on the public. The people who listen to a talk can often understand much more than you give them credit for.”

“Trying to explain without blinding people with technicalities or cleverness but not trivialising and not necessarily simplifying it.”

“There is a problem with visibility of science in the media. People have a very short attention span. You have to try to reach as many people as possible without neglecting the high quality contact with small number of people.“

“Many scientists involved in making a press release exposing their work are most worried by the reaction of their peers.

“It’s certainly a problem that the science community do not understand the work of communicators. “

“If there is no scientific paper backing a press release there’d better be pretty good reasons and you must be prepared to suffer the consequences.”

“A recommended code of conduct in the form of guidelines is a good idea, but rules are not.”

B.3 André Heck

B.3.1 Short Biography

Prof. André Heck is a first-class Astronomer at Strasbourg Observatory in France and has a life-long devotion to astronomy and scientific public outreach. He holds a D.Sc. and a degree in communication techniques and more than 140 refereed and/or review papers on a broad range of themes. His editorial production is impressive with some 70 books as author or editor and more than 1400 papers, quite a few of them being directed to the public at large – a return towards the society that he never neglected. He has also launched a novel series of volumes devoted the organizational, strategical and sociological issues in astronomy and related disciplines. He produced quite recently an edited book on the multinational history of Strasbourg Observatory.

B.3.2 Statements from Interview

"Credibility occurs if the message that you conveyed has been received credible by the receiver."

"You can have a completely wrong message but, if it makes sense, then you are credible – bluff works that way."

"You can be credible without doing a good job – you can e.g. be an astrologer."

"You are largely responsible to tailor your message in a way it is well received."

"A credibility problem definitely exists, and it cannot be solved through golden rules."

"Many astronomers live in their own little crystal sphere and do not care about the outside world, which is a lack of social responsibility."

"The credibility problem lies at different levels – scientific information might not be expressed properly, the message might not be conveyed adequately, or the end-user does not understand it properly."

"Idealistic astronomers should be reminded about their social responsibility because the society has paid for their education and their salary is frequently covered by taxpayer's money."

“The general public rate astronomy first as what is most interesting science, but life science first as where to spend the money. That is why astronomy is getting less and less funds.”

“The scientists try to get funds by either public support or citations – both can be influenced by non-objective factors.”

“Science communication is a matter of quality not quantity.”

“Some years ago, an announcement that life had been found on Mars made all the headlines and even triggered some words from the US President (Clinton). Interestingly this took place shortly before a NASA budget was to be approved by the US House of Representatives or by the Senate. Of course, no life has ever been found of Mars, but the subsequent rectification remained almost unnoticed in the news.”

“The problem for science communication is that the public is retaining the big news even though it is wrong and possible subsequent rectifications remain unnoticed.”

“A good press release informs accurately and is being well understood.”

“The best message is the short message – short, flashy, attracting, teasing.”

“Behind hype is the problem of visibility and recognition – the fight of organisations, laboratories or people for money.”

“People who have benefited temporarily of hype can afterwards pay this very dearly, either because they either deserve it or because a lot of people are jealous.”

“An ethical charter, not only from IAU, but also from all organisations, that would be of application to scientists and communicators would be highly desirable.”

B.4 Robert Hurt

B.4.1 Short Biography

Dr. Robert Hurt is the visualization scientist (pubic affairs) for the Spitzer Space Telescope, part of NASA's "Great Observatory" program. In addition to his current work on Spitzer, Dr. Hurt has previously worked as a staff scientist on the Two Micron All Sky Survey, and a postdoctoral fellow on the ESA Infrared Space Observatory. Dr. Hurt received his Ph.D. in physics from UCLA in 1993, and his research interests include gas dynamics in starburst galaxies, local star formation, and luminous infrared galaxies.

B.4.2 Statements from Interview

"In order to make sure we keep credibility, everything has to be correct."

"In public affairs you are pulled between two poles, sensationalizing the results and correctness."

"Spitzer has a long review process that relies on the scientist's approval."

"I do not think there is a credibility problem, because most press releases are fairly much on the mark."

"If the science community loses credibility with the general public we face a significant danger of loss of interest and loss of ability of communicating important things they need to know."

"Science covers many things but for the public it is a small field – misrepresenting can hurt all scientific areas and have a kind of halo effect."

"The primary concern of scientists with regards to credibility is to lose credibility among their peers."

"A scientist must have a public identity before he or she is likely to worry about personal public credibility"

"If the scientists do not trust the communicators, they will not come to them again. And equally if the journalists lose trust in communicators, they are not going to print the story. The credibility has to be maintained."

“What ever you do, you have to keep your credibility with your collaborators.”

“Good science communication is taking a scientific technical result and clearly communicating it to a non-technical audience.”

“Engage the audience and give them flavour for the processes of science and then you have succeeded.”

“We primarily target the larger mass media, but we also try to hit the more informed media.”

“The most interesting and frustrating thing about press releases is the limited space for telling the actual science story – definitions of key terms and even some results often get left behind, because there is not enough space.”

“We try not to compare Spitzer images directly with lower resolution or lower sensitivity ones from previous missions. This could be perceived as trying to "show off" and devalue the importance of prior work.”

“We try not to put out a press release without a published refereed scientific paper, but sometimes you do not have a choice.”

“You really have to clarify the nature of the sources when you do not have a refereed scientific paper.”

“Hype has been beneficial to the scientific community, because reporters need to know why this is interesting to their readers.”

“Science communicators have learned to find the hooks.”

“It can be difficult to work under mandatory guidelines that are applied broadly to all releases. Guidelines can be helpful for consistency, but they should also reflect the real needs of journalists and be applied flexibly in situations where they can be counterproductive to communicating the story.”

“Guidelines should be more how to deal with the critical phases.”

“Any chink in the armour of credibility can make the entire scientific community vulnerable to attack.”

B.5 Bruno Leibundgut

B.5.1 Short Biography

Dr. Bruno Leibundgut is head of Office for Science at European Southern Observatory (ESO) and an internationally recognized top researcher in astronomy within supernovas. He has, besides his production of many scientific papers, also written several popular science articles. He is currently chairman of the press review board at ESO who reviews the ESO and ESA/Hubble news and photos releases.

B.5.2 Statements from Interview

"ESO has no formal obligation to communicate ESO results to the outside world."

"Time has changed – scientists now also have to do science communication."

"Science communication has become more and more important."

"Here at ESO we have followed the excellent example of STScI/OPO."

"I don't think a credibility problem exists at the moment. When reading a newspaper only in your own field do you see the shortcuts taken in the communication process. However, one cannot hide behind this really."

"You need to earn credibility every day."

"I don't think there is a large difference between the US and Europe with respect to credibility. The US is more aggressive, but do not necessarily do something wrong."

"The public communication works on different time scales than the scientific process."

"In our editorial board we cannot re-reduce the data."

"A press release targets both the public and the fellow scientists."

"Good science communication is about the delivery. It's about excitement. It's about answering the question why this is important for people. It's about beauty and attraction. Good science communication has to be correct. Analogies are for example often too simple or even wrong. And it is important to involve the astronomers. For the actual work it is a balance between the scientists and the PIO."

“No scientific result came out of a vacuum – they all build on previous results.”

“There ought to be a scientific paper before the press release. The main reason for this is that someone has sat down and thought things through carefully. A refereed paper gives an objective opinion. If there is no paper, then the evidence has to be shown: graphs, data, pictures … Whether a press release needs a paper depends highly on how complex the science is. Whether it is “on/off” or a “complex technical” result.”

“If we lose credibility we lose support and people will get disinterested. It may lead to a long-term downsizing of the whole astrophysics.”

“Fundamental science is more susceptible to the loss of credibility than applied science.”

“Credibility in science communication is very important.”

“Also PIOs can lose credibility with the scientists and this is very bad.”

“A formal code of conduct may be good, but I am not sure how to implement it.”

B.6 Mario Livio

B.6.1 Short Biography

Dr. Mario Livio is a Senior Astrophysicist at the Hubble Space Telescope Science Institute, and the previous head of the Institute's Science Division. He is an internationally known astrophysicist, a bestselling author, and a popular lecturer. He joined the STScI in 1991 as head of the Archive Branch. Prior to coming to STScI, he completed his undergraduate studies (majoring in both physics and mathematics) at the Hebrew University in Jerusalem, his M.Sc. degree (in theoretical particle physics) at the Weizmann Institute, and his Ph.D. (in theoretical astrophysics) at Tel-Aviv University. He was a professor of physics in the physics department of the Technion-Israel Institute of Technology from 1981 until 1991.

B.6.2 Statements from Interview

"A credibility problem does not exist in science communication today, as the review process is very heavily scrutinized due to several people checking the veracity of a press release."

"In the history of Hubble there have been very few problems with accuracy."

"Most press conferences are held after the arrival of a refereed paper. The few exceptions are indeed when the results are being transmitted live. During these live transmissions the emphasis is not at the results, as they do not exist at the point, but instead it is the drama of the observation that is in focus."

"The credibility question regarding live-events does not exist. Instead the question should be: Does the given observation qualify for live coverage?"

"Good science communication should be interesting to the public and make them able to understand exactly what the importance of the finding is."

"Good science communication enhances the public interest in science and encourages young people to go into science – we do not always achieve that, as the public opinion sometimes differs from that of scientists regarding the interest of a finding."

"When using words like "may", "could", "possible" etc. the news media does not find these stories to be exciting enough, and does therefore not print them. This results in press releases that sometimes have a very slim chance of being interpreted right."

“The one event which is always quoted being a failure in terms of credibility is the NASA 1998 Extrasolar Planet.”

“The NASA 1998 extrasolar planet press release actual did had cautious words like “may”, “possible” etc.. They did however not appear in the article presented by the journalist – in hindsight we should not have made that particular release.”

“You can not avoid that something is proven wrong later – it is the way science progresses.”

“Given all the information you have, you should be convinced that this looks correct. It then might be proven wrong later on.“

“If fundamental information in your press release is proven wrong you might have to release a new press release regarding the revision of the results.”

“It does not make sense to retract a press release that is proven wrong, unless this occurs within a short time of the emission of the press release. I do not believe that people remembers earlier releases.”

“We always give credit to others who has done work before. If a specific telescope has some unique capabilities then we emphasise the observatory. However this only occurs if the foundation of the results is based on the specific capabilities of a telescope.”

“We have a very long and rigorous procedure for transforming research results into a press release. It involves many people who need to approve the release.”

“I do not believe that there exists a serious problem regarding credibility in modern science communication, and does therefore not believe that a common code of conduct is needed.”

“It is very hard to gain credibility, and very easy to lose it. “

“Losing credibility would be a disaster as the public would not take you seriously and therefore you would achieve the exact opposite of what you were trying to achieve.”

B.7 Dirk H. Lorenzen

B.7.1 Short Biography

Dirk Lorenzen is a senior science reporter for German Public Radio and major newspapers since 1994. He covers astronomy and space flight. Mr. Lorenzen graduated in astrophysics from Hamburg University. He authored five popular books about astronomy and has given hundreds of public talks. Mr. Lorenzen is a member of the executive board of the German Association of Science Journalists. In 2005 he chaired the Participants' Forum "Europe in Space: Taking off without the public?" at the conference "Communicating European Research" in Brussels, organized by the European Commission.

B.7.2 Statements from Interview

“I find my stories and news by checking web pages, checking press releases, reading Nature or Science or articles on astro-ph. In some cases I get in touch with astronomers and go to conferences.”

"I do not really trust press releases – I always have to check them.”

“It is the responsibility of the journalist to check the press releases.”

“If someone issues a press release they want you to have a special view on a case.”

“Press releases do not mention errors and sometimes they are published for political reasons.”

“If I can not talk to the scientist I will not follow the story.”

“I trust the scientific paper more than the press release, but the papers are done by humans and humans can be wrong.”

“I do trust some organisations more than others – unfortunately.”

“Peer reviewing is a slow process. I think you have to communicate fast.”

“If you have a beautiful image then you do not need a refereed paper – Hubble does this perfectly, while ESA does not.”

“If the press release is done in a perfect way it will start with some hype, but it is ok – it is journalist’s job to question it.”

“If based on sound facts hype can be beneficial.”

“Credibility is about honesty and presenting your organization well.”

“You are never allowed to lie – to me people who lie are dead to me and to my colleagues too.”

“It pays in the long run to tell about mistakes. Only if the press release is entirely wrong, you should make a new one.”

“It sounds very nice with guidelines and everybody will tell it sounds great, but it will not really work.”

“The general trend is that the better and the younger scientists are, the more willing they are to communicate.”

“Good science communication should tell a story and not communicate too many facts.”

“Good science communication has to appeal to the public and needs a human touch that most scientists do not like.”

“The Americans are better at communicating – but American scientists have also much more pressure to get their research in the news and sell the story.”

“You have to be more careful if you read American press releases.”

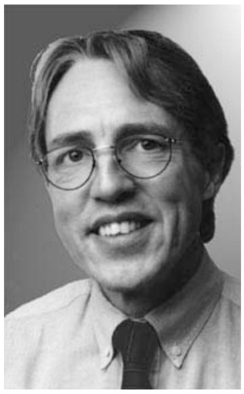
“We need a shift in the attitude towards science communication – it is not only a problem of the PR people but also of the scientists.”

“Communication is important and it makes it worthwhile for all including the scientists, but the scientists do not realise that.”

“Science communication is not visible enough for the general public and in science communication it is very important to communicate to the people that pay for it.”

B.8 Claus Madsen

B.8.1 Short Biography



Claus Madsen is head of the ESO Public Affairs Department. In 1980, he joined ESO, concentrating on wide-field scientific imagery of the Milky Way, the Magellanic Clouds and the Local Group galaxies. Since 1986, he has focused on science and society issues, organising exhibitions, producing films and giving public lectures on astronomy. He is co-author of the book 'Exploring the Southern Sky' (Springer Verlag, 1987). Between 2000-2005, as European Affairs Officer he coordinated the relations between ESO and the EU. He participates in several EIROforum (a partnership of European intergovernmental research organisations) working groups on aspects of European science policy.

B.8.2 Statements from Interview

"As far as I know, we are the only organization, which provides an accurate description of the purpose, procedure and underlying philosophy behind press releases including their relationship vis-à-vis the original scientific paper – in other words a precise tool for the proper understanding of a press release. We do this to make this difference obvious to everybody and to support our credibility with the science journalists."

"The communication process at ESO is as follows: 1) Firstly, we normally require a scientific paper which has been accepted for publication in a bona-fide scientific journal. 2) The original paper is subjected to a further internal review at ESO by an internal review board, which consists of 5-6 members. Their job is entirely to evaluate the technical and scientific content of the paper. 3) Provided that the internal review board also 'accepts' the paper, we start preparing the first draft for the actual press release. This is done in close collaboration with the original authors, but may also involve other parties (graphics specialists, media people, etc.). 4) The draft press release is evaluated again by the internal review board. This time their task is to spot possible scientific mistakes or expressions in the release that might cause misunderstandings."

"The media – also in Europe – gives priority to NASA news and we have the impression that the media accepts nearly all that is published by NASA – because of this we have little chance to be heard if we send out a press release on a particular topic at the same time as NASA."

"When at the time of the ESOF International Scientific Conference we published the press release about the extrasolar planet in orbit around μ *Arae*, we made sure to make the journalists aware of fact that this particular press release was based on a submitted, but not yet accepted, paper. The urgency of publishing this release was due to series of external factors, but the scientific paper was in fact accepted shortly thereafter. This did not seem to bother journalists, but later at a press conference in the US we were heavily criticized for this – though indeed not by the journalists!"

"Given that NASA quite often appears to make news announcements, which are not supported by an accepted paper – which can of course be justified in the case of a scientific meeting for example – we're indeed puzzled by criticism from NASA when, on rare occasions, we publish a press release based on a submitted but still-to-be accepted science paper."

"Credibility is a principal asset of ours."

"Press work is work 'in the fast lane'. Occasionally, the lengthy procedures that we follow at ESO to prepare a press release, including the time needed for our scientists to verify our statements, entails the risk that we might be 'scooped' by others. However, this is a price we are ready to pay to maintain the trust of the media."

"One of the greater conflicts is within the search for extrasolar planets and gamma-ray bursts. Here there is very hard competition."

"Within the confines of science, proper referencing is an integral part of 'good conduct'. In the public domain, especially in hotly contested fields of science, we see that both PR people and some scientists find it hard to acknowledge achievements of colleagues."

"I do not believe that – per se – scientific research lacks public support, but it is not 'an unquestioning support'. The issue is confidence. It is important to remember that great advances always have two sides. This was seen in the last century, e.g. in nuclear physics, which of course also brought about the nuclear bomb. Today, it is clearly a problem in the life sciences where we see a great increase in ethical issues. Nanotechnology is an area which could pose similar problems."

"Vying for public attention is a struggle to be fought every day. Getting into the public mass media is not simply a question of the quality or merit of the 'news' itself. It is a question of understanding – and mastering – the 'news game' in a climate dominated by harsh competition with less ethical stops than we would sometimes wish. I am concerned of what this does to the credibility of science in the long run."

"If the claim put forward in a press release turns out to be wrong, we normally leave it at the webpage, but we do insert a 'disclaimer' so that the press releases can be read and understood in the light of more recent findings."

”A press release is not simply a document which describes results of research; it documents the fact that a research result (often associated with specific claims) has been publicized. In this sense, the data can be wrong, but the press release will still be correct. Science is a living process: something true one day may be proven wrong, based on new evidence, the following day. A press release is only valid as such at the time of its release and with the knowledge of the moment.”

“It is important to realize that a press release is not a scientific paper.”

”I believe that a code of conduct will be a good idea. It would not provide any guarantees, of course, just like the traffic code: If may be violated, but at least it provides a set of rules for everyone to go by.”

“Because our fundamental task is to serve European scientists, I do not have any issues with other people being mentioned before us, as long as our role is still acknowledged.”

“We are not afraid of referring to other research teams, organizations or results obtained by other scientists.”

“As the search for extrasolar planets is directly linked to the search for life and as such is one the most fundamental interest of many people, this field is in great danger of being hyped.”

“With respect to credibility, you can decide to implement procedures and standards just as we have done. But it must be understood that the mediation process operates according to its own rules and the normative idea that many scientists seem to entertain, that they should or could somehow decide on how a certain story is reported, is simply naïve.”

B.9 Govert Schilling

B.9.1 Short Biography

Govert Schilling is a science correspondent and former programme leader of the Artis Planetarium in Amsterdam. He writes regularly on science topics for the Dutch newspapers de Volkskrant and Vrij Nederland, as well as the American and British magazines Sky & Telescope, Science and New Scientist. His previous books include Werelden naast de aarde (Worlds Near the Earth, 1990), De salon van God (God's Salon, 1993) and Tweeling aarde (Twin Earth, 1997). He is autodidact in astronomy and journalism and has written more than 40 books on popular astronomy and many more articles.

B.9.2 Statements from Interview

"I find my news by reading magazines. This is where I normally have my background stories from. The web is getting more and more important. I also subscribe to mailing lists and have many personal contacts. I talk to scientists at press conferences, lectures and sometimes the researchers call me"

"I do not use PIOs very often to get information. I meet them at the AAS meetings, and I know them, but I prefer to talk to the researcher instead. In this way I can do background checks."

"The difference between a normal journalist and a science journalist is that the normal journalist does not have the contacts and does not know whom to call."

"As a journalist you have to keep in mind that PIOs determine which topics get released."

"I am a trustful person and I trust the PIOs, but there is said to be a lack of trust between PIOs and journalists."

"It is very important to work together and it is important that journalist do not suspect the PIOs for lying."

"To me it is very important not to base a story on misinformation. I want to be sure that everything is accurate and I believe it is the personal responsibility of the journalist to get it right."

“As a journalist you have to be aware that PIOs will not tell you of competitive research, and it is the journalist’s duty to check up on this.”

“The difference between science journalists and normal journalists is that normal journalists do not have time to check the press release, because of deadlines – you can not blame them.”

“Every serious science journalist knows that press releases are made by PIOs who emphasize their own organization.”

“You can not expect the PIOs to also tell about the problems they encounter.”

“It is important to get media response. This means that the amount of press releases increases just before the government is about to give out funding.”

“The more the people from the government see your work, the more they can relate to it and the more money they will provide to the organization.”

“NASA certainly would benefit from positive and frequent media exposure in a time when congress is deciding on things like Hubble maintenance.”

“I believe there is a big problem with scientist not wanting to communicate their research. As a colleague said “I have never encountered an episode where a poet says, that “I am probably not the right poet to ask about my poem”, this happens all the time with scientists.”

“The scientist is afraid

1. The communicator will simplify his work.
2. To receive bad response from his colleagues.
3. His colleagues will think that he is too eager to get in the press
4. Being looked down upon by other scientists”

“Scientists do not understand why it is important to make simplifications, but it is the simplification that helps you get the message across.”

“There are big differences between US and Europe, but the biggest difference is the willingness to communicate.”

“In US you need to get money every couple of years. This makes it important to be seen in public, because this is where the senators see you, and they might recognize your work when the funding is being paid out.”

“The younger scientists have grown up in a world of communication, but they have to be careful not to make mistakes while a mistake can damage their career.”

“The topics that interest the public the most are black holes, extraterrestrial life, extreme physics and cosmology.”

“It is not always that a scientific paper is needed, but if there is I will always have a look.”

“I use the paper to look up literature on the subject, for background information and I check if it has been done before.”

“Peer reviewing and a scientific paper give no guaranties that a press release is solid facts.”

“If a press release turns out to be wrong you should put out a new press release and look for a good angle to make the mistake more positive.”

“Terebey did everything right, she had a paper, a press release, and later a accepted peer reviewed paper and she published a new press release when it was proven wrong.”

“In hindsight the NASA 1998 extrasolar planet press release was too strong and too confident, but because it was published at a NASA Space Science Update, everybody believed it.”

“NASA should only have sent out a press release with an image and some background information for the 1998 extrasolar planet.”

“The public do not care if the research turns out to be wrong – it gives the right view on science and that searching for extrasolar planets is a high goal.”

“It does not matter if results are proven wrong – this is how science works.”

“A code of conduct is not a good idea, since there will always be a lot of competition. Scientists and PIOs will always want to beat the other organizations.”

“There will always be competition between PIOs and PIOs, scientists and scientists and journalists and journalists.”

“There is hype everywhere and everybody is doing it.”

“There is nothing wrong with hype – it opens new fields.”

“Hype can in some ways be beneficial while it makes science less dull, because the exciting subjects are often being hyped.”

B.10 Neil DeGrasse Tyson

B.10.1 Short Biography

Dr. Tyson has often been called “The Carl Sagan of our time” – he is director for the Hayden Planetarium in New York and has been appointed by President Bush to serve in the 9-member commission “Implementation of the United States Space Exploration Policy” in 2004. Tyson's contributions to the public appreciation of the cosmos have recently been recognized by the International Astronomical Union in their official naming of asteroid “13123 Tyson”.

B.10.2 Statements from Interview

“What matters to one person, does not matter to another person.”

“It is important to know whom you are speaking to, when you communicate. It matters to me what matters to them, because I will use this to communicate to them. It is harder now than ever before to know what matters to them, because people have so many different references to many different media.”

“Money matters – NASA money is tax money, the National Science Foundation money is tax money and I believe that the scientists have realised this.”

“The members of congress are not scientists, and this means, that when communicating to the public you are also communicating to the members of congress.”

“After the Cold War, astronomy could not expect money from military funding any longer.”

“In America the increasing capitalism means that the amount of money you make, defines your amount of success, which results in science communicators needing to adapt their press releases to reaching large crowds.”

“A credibility problem doesn’t exist in America anymore, due to Carl Sagan’s appearance on Johnny Carson and the Tonight Show.”

“People were astonished that Carl Sagan would reach that far into the land of entertainment and talk about science. Today I do that all the time, provided my content is real.”

“My job description is partly to bring science to the public.”

“Many American press releases exaggerate the significance of a finding, to the exclusion of other work, which may be of a good quality, but lacks the machinery to publish it. It concerns me, but not to the extent to take any action.”

“Communicators need to get the attention of the media, but unless the press release includes superlatives, they worry that the press will not see it.”

“Temptation is high to exaggerate findings.”

“The temptation for hype is huge.”

“Good journalists will not only speak to you, but also to your competing group.”

“You should only make press releases with enough superlatives to impress the public. It should not be to inform scientists.”

“There is nothing wrong with being wrong, but you do not want a press release coming out in advance of a peer reviewed publication of an article. Then you are breaking scientific protocol.”

“95% of news is local news”

“If I, in theory, send out a press release and the story turned out to be wrong, I should send out a retraction, if the story started to escalate.”

“If you do not have a scientific paper backing your press release, it could turn out to be the end of your carrier – this happened to the scientists involved in the cold fusion”

“Scientists do not want it to look as if they are stooping to the level of the public in case one of their colleagues sees it.”

“Scientists try to keep a high level, so they can still stay high up on the ladder.”

“The publication of the retraction by Susan Terebey is a noble gesture which would normally claim high respect.”

“Susan Terebey should have published the paper and not issued the press release, as she would still get credit if the results proved to be true. Publishing the press release before the scientific paper was accepted would not be tactical.”

B.11 Ray Villard

B.11.1 Short Biography

Ray Villard has specialized in communicating astronomy to the general public for the past 20 years. As Public Information Manager for the Space Telescope Science Institute (STScI), he is responsible for disseminating news about the most recent discoveries made with Hubble Space Telescope. He previously was associate editor for Astronomy and Star & Sky magazines, and has written a variety of freelance articles. He holds an M.S. in Science Communication from Boston University.

B.11.2 Statements from Interview

"To ensure accuracy you will have to make sure that everything you make available to the public must be true and accurate."

"To make something interesting and glamorous is not hype – hype is when you take credit for more than you deserve."

"Scientists who hype will in time lose their credibility with their peers."

"The level of accuracy is irrelevant if no one pays attention."

"In the process of simplifying, or glamorizing, it is easy to introduce errors."

"If you hype, you will lose credibility."

"If you try to popularize science you risk being accused of hyping."

"The organisations have an obligation to share its information with the public."

"I do not believe that a credibility problem exists between science organisations and the media in general, however there are an issue regarding NASA who is often perceived as having a tendency to hype their results."

"Science communication needs to be exciting in order to get the public's attention."

“In good science communication, getting the public’s attention is more important than accuracy. In order to achieve this you should use simple language, and make the subject relevant to their everyday life.”

“Bad science communication is when you expect the public to understand difficult technical terms, and thereby do not get their attention.”

“People are amazed of the beauty of pictures in astronomy, which adds another aspect within science communication.”

“We translate the information to an appropriate level in order to make the public understand and to gain their interest.”

“It is a great challenge not to look like you are diminishing other facilities when emphasising your own observatory.”

“It is bad science communication if you choose to emphasize the least plausible explanation in order to make it interesting to the public.”

“Science is a self correcting process, in which you are bound to make mistakes. About half the published papers need some degree of correction.”

“Many astronomers accuse NASA of hyping, partly due to the Mars meteorite suspected of containing fossil evidence for microorganisms; I however believe that it is necessary to publish exciting results quickly in order to get the public’s attention.”

“Scientists can be overly concerned about the accurate reporting of their work due to criticism from their peers. However, regarding the public, no one complains about mistakes being corrected as they see it as a natural part of the scientific process.”

“The biggest problem in science communication is the fact that many scientists disagree with the need to publish fast, due to criticism from their peers.”

“A press release should not always wait for a peer reviewed paper, as some discoveries can be too important to remain secret for long.”

“I do not put much credence in reviewed papers, as I do not think they guarantee accuracy. Peer reviewing pleases the scientists, but not the public. There are plenty of examples where peer reviewed papers turned out to be wrong.”

“You can be more flexible with astronomy than other sciences such as medicine. At least if the result is later proven wrong it will not kill anyone.”

“The scientist does not understand what the public comprehend and find interesting, and needs to accept what the public affairs professionals bring to the table.”

“If you make a terrible mistake, you should make a correction, not a retraction.”

“A long-term consequence of losing credibility is that reporters will not pay attention to you.”

“Once credibility is lost it is very hard to achieve again.”

“Science communication has to achieve certain balance in both simplification and accuracy.”