University of Otago

# Funnily Serious: Using Comedy to Communicate Science

**Andrew Scott**

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Centre for Science Communication, University of Otago, Dunedin, New Zealand

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# Abstract

The public perception of science and its practitioners is one of stoic seriousness or of laughable arcana. But science and humour have had a long (if marginalised) history together, from in-jokes and jocular critiques inside the scientific community, formal education and through to public communication of science in the media. The growth of the use of comedy in a scientific context is such that now scientific topics are often included in the repertoire of mainstream comedians.

The various uses of humour to communicate scientific ideas is examined, why it is employed, and its effectiveness assessed. The trends in the use of scientific humour are charted in academic papers, popular science writing, film and television documentaries and stand-up comedy. A categorisation of comedic approaches is made based upon the relative "dilutions" of science and comedy, and the merits and drawbacks of each approach to communication are compared and discussed. It is also argued that the recently growing presence of scientific topics in mainstream comedy may be an indicator of the public understanding of the topics in question.

This thesis shows how humour can have a successfully "humanising" effect upon science education, both formal and casual, in a wide variety of media. It argues for the effectiveness of a comedic approach to science in order to reach wider audiences. Finally, the use of comedy to communicate scientific concepts is examined in the creative component of the thesis, the documentary film *Tangled Waters*.

# Rationale

The following is an outline for my thesis. The thesis is comprised of two parts here are required material for the completion of : a creative component in the form of a 25 minute documentary film and an academic component in the form of a written dissertation. The two are included together here as the required material for the completion of a Masters in Science Communication at the University of Otago.

*Creative Component:*

The film I have created with my partner, Nicole Schafer, is about the shark nets of Otago. Dunedin City Council spends a little over $38,000 of taxpayer's money each year to purchase and maintain anti-shark nets along St Clair / St Kilda beaches. They were put in place after a series of attacks by great white sharks in the 60's, but the nets don't cover the whole beach and have huge holes in them – big enough for sharks to swim through.

The nets do catch sharks, of that there is no doubt. However an entire third are caught on the inside of the net: caught as they tried to swim back out to sea. They also are a deadly hazard to many other sea creatures.

This film seeks to highlight the fact that the Great White is protected by international and New Zealand law, except when they are swimming off St Clair and St Kilda beaches. It seeks to look at the sharks of Otago and Southland and the local people whose lives have been affected by them, and it seeks to highlight the ludicrous nature of the beach netting with our unique weapon: humour.

You're more likely to be bitten by a dog at the beach then by a shark. Why don't we put up dog nets?

In essence then, it's a funny film about sharks.

*Academic Component:*

The academic component of this thesis seeks to provide a review of the use of humour as a means of communicating science.

Humour has been described as a “prophylactic against learning”. While comedy maintains an enormous power to undermine messages, skilful use of humour can provide an effective tool in the arsenal of the science communicator.

My dissertation will look at the use of this humour in film, television and new media, the modes of humour used and its perceived effectiveness in conveying science.

It will also examine the appearance of scientific concepts within mainstream comedy, and how this can be used as a barometer of scientific understanding in the popular zeitgeist.

# Acknowledgements

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# Introduction

The topics of science and comedy could, at first glance, seem to be wholly unrelated. The former – a constrained set of methodologies designed to create an objective investigative process – would appear to be wholly antithetical to the latter, a mode of provoking a pleasant emotional response from its participants in a highly subjective manner. Yet these apparently opposing systems can, in concert, become a powerful educational tool. This thesis will attempt to demonstrate why.

To do this, we must first establish what we mean by the term "comedy". Throughout this thesis, the word is used in the following sense, as per its definition in the Oxford English Dictionary:

> *"Humour; humorous invention; the action or quality of being amusing."*

As such its usage here is interchangeable with the word "humour", and should not be confused with the classical Greek meaning, which denotes a dramatic theatre form that is distinct from the modern definition.

There is a general paucity of scientific study on the use of comedy as a means of communicating science. While some research exists on the use of humour in a broader educational context, there have been comparatively few studies published until recently, i.e. within the past decade. What studies that do exist seem to be carried out in isolation from one another, and there is little cross referencing between studies carried out between academic spheres (for example, between academic sciences and formal pedagogy). As such, analysis of this kind of educational technique is still very much in its infancy, with many possibilities still to be explored.

This thesis will give an overview of the use of comedy in science, with each chapter focusing on a particular aspect of "science comedy". The aim is to bring together formerly disparate studies on the subject and provide a guide to the most common ways in which science and comedy has been and continues to be used to convey concepts to

end users. By collating these methods, a new synthesis for approaching the topic can be created, so that further study can be better coordinated and informed.

Chapter One examines the use of humour within the scientific establishment, its use in the past as an explanatory and dialectic tool, and its place within modern scientific "geek" culture.

Chapter Two analyses the use of humour in formal pedagogy. It looks first at the neurological and psychological reasons why it may benefit the teaching process in primary, secondary and tertiary institutions. It also comments on the hypothetical and practical limits of its use, and the extent to which comedy can be abused or simply fail in a classroom context.

The third chapter looks at comingling of science and comedy in the mainstream media. The various attempts to disseminate factual content within various entertainment formats are analysed in film, television, print and music. It also examines the rise of scientific topics within stand-up comedy, and how this can be used to gauge the public's understanding of science.

Finally, chapter four looks at how comedic techniques have been employed to communicate science in the creative component of this thesis, a 25 minute documentary film on the subject of anti-shark netting, *Tangled Waters*.

This text also attempts to categorise the uses of "science comedy" with a simple model. By conceiving of science and comedy as two separate components, the Medium of comedy and the scientific Message, it is possible to create a rough continuum or "distillation model" by which three broad categories can be constructed to show the relative "dilutions" of science and comedy. Various modes of "science comedy" are examined in this context, which helps to give a clearer understanding of their purpose and audience.

**Table 1. Categorisation of Science Comedy**

| 1% Comedy | | 99% Comedy |
|---|---|---|
| | | |
| Category 1 | Category 2 | Category 3 |
| Science focussed content. Some comedy used as relief or case studies.<br><br>Usual outlets: academic papers, lectures, "straight" science documentaries. | Roughly equal scientific and comedic content.<br><br>Usual Outlets: Children's education (TV, books), popular science literature. | Comedy focussed content.<br><br>Scientific concepts used as basis for humour.<br><br>Usual outlets: Satirical comedy, stand-up comedy. |

This scale is set by taking into account the relative percentages of content given over to science and comedy within a given medium. In most cases these can be simply calculated via word or sentence counts in printed media, or runtimes in audio/visual media. The percentage given over to comedy in a scientific topic can be expressed as in *Table 1* above. 1-30% is designated as Category 1, 31-60% as Category 2, and 61-99% as Category 3.

Each category provides a framework for the kind of content it describes. Category 1 has a relatively high ratio of scientific content to comedic content. In Category 2 both modes of content are roughly equal, and in Category 3 the content is skewed towards the humorous. Each category can be expected to correlate with certain types of media, and the following chapters will demonstrate which are typically (but not always) placed in particular categories. The comedic content of the creative component of this thesis will also be subjected to this categorisation, which aids in finding its comedic correlates in outside media.

# Chapter 1: Humour in Academia

*"The more you find out about the world, the more opportunities there are to laugh at it."*

Bill Nye

Scientists appear to be inherently serious – their profession requires what often appears to be a stoic rigidity and conformity to strict protocols, as per the requirements of the scientific method. As a result, the profession of science and its practitioners would appear to be infertile ground for comedy. Persons outside of the scientific establishment may find much to lampoon here: studies into the public's perception of science and scientists have been conducted on several occasions, with usually unsurprising results. Barman (1997) notes that children, when asked to draw what scientists look like, tend to conceive of scientists as lab-coat sporting, bespectacled Caucasian males found only inside laboratories. Further observations by McAdam (1990) suggest that this is a pervasive view of scientists – sometimes developing from a comedic "mad scientist" archetype during early education before settling into the more prosaic 'white coated' version. David Chambers (1983) has popularised a "Draw-a-Scientist" test that was initially trialled in Australia, Canada and the USA, in which school children are asked to draw their conception of what a scientist looks like and where they work. These impressions appear to transcend geographic, racial and socio-economic strata, at least within western nations (Finson 2003). The test has been shown to produce different results when deployed in different cultural groups, but a common thread of misconception of science still persists (Farland-Smith 2009). What is more surprising is how these views persist into later life (McAdam 1990).

Pion and Lipsey (1981) note an appreciation of the utilitarian function of science and its technological products amongst high schoolers, university students and adults, but also recorded the view of science as a dull, nebulous process and of scientists being perceived in much the same light. Scientists, even within their own academic culture

(McAdam 1990; Kilbourne 1996), are either figures of fun; a baffling social unit set apart from the mainstream; a group involved in an ultra-serious and arcane practice; or at worst, a secretive society which poses a dangerous threat to the general public. There is little in the way of positive levity in any of these descriptions. Indeed, the properties of humour seem to be at polar odds to these perceptions: science being a paradigm of emotionless objectivity, humour a realm of total emotive subjectivity. Science seemingly deals in immutable facts; comedy has a definition that is rarely the same between individuals (Kuipers 2006).

The prevalence of humour in scientific academia is greater than these descriptions would suggest. Ewin D. Kilbourne's (1996) study of humour within the academic sphere goes some way to exposing the ways in which comedic devices are employed to communicate ideas, and demonstrates the humanity behind their processes. These instances are infrequent and easily missed, or lost as they are deeply embedded in volumes of serious discourse.

Guides to science writing usually make sparing reference to the notion of using humour as an option for scribing scientists, but offer little in the way of detail as to its use. Alley (1996) notes in his guide to scientific writing that the use of humour can serve to make large blocks of "hard science" more easily digested by providing breaks of levity. These serve as a mental breathing space and help make the readers more comfortable with the text – an emotional cushion against the seemingly impenetrable nature of facts and statistics. This also performs the function of compartmentalisation: sections of writing or presentations are delineated by the humorous breaks, making what would otherwise be daunting lumps of writing more manageable and "bite-sized". This pattern of "Serious Text" punctuated at the end with humour may also be helpful to the writer or presenter, allowing them to break the ideas to be conveyed down in into their constituent concepts, and thus defining the outline of their structure. Such patterns in isolation would conform to Category 1 in the Distillation Model, their relative frequency serving as a counterpoint to the main scientific message, without overwhelming it.

Humorous breaks in a scientific narrative serve another function, as "check-points" for the audience. It has been established that the longevity of sustained attention span in adults is around 20 minutes, but can be refreshed by small lapses in attention. This is why movie audiences are easily able to focus on films with runtimes of 120 minutes and longer (Cornish and Dukette 2001).

Given this knowledge, presenters may be able to work with this pattern of attention and relief: by breaking with the current flow of attention, humorous interjections in presentations and writing serve as attention resets. These breaks allow the audience to re-engage with the presentation. Timing these injections of humour to coincide with or pre-empt natural attention lapses, presenters can ensure that these 'refreshers' occur regularly enough to maintain the audience's attention for the whole duration of their performance.

While the likelihood of encountering humour in the context of a presentation is relatively high, its presence within formal publishing is less expected. However, as Lewin (1983) notes, jokes do manage to creep into scientific literature on occasion. These tend to occur predominantly in biological sciences, possibly as a meta-reaction to the perceived strangeness of many aspects of the observed phenomena in the subject. Lewin catalogues nine separate instances (between 1923 and 1983) of spurious descriptions of new plant and animal genera, with a common denominator in each being the meticulously detailed nature of their exposition. The intention appears to be a test of skill in an attempt to bamboozle serious publishers into printing bogus studies – fakes which display such a high degree of creative flair and scientific accuracy that the most educated reviewer is taken in.

On the face of it, such fakery may appear to be a destructive act of anti-science on a par with such hoaxes like the Piltdown Man or Archaeoraptor. But the intention here is belied by the obscurity of the hoaxes: a description of a breast-shaped cactus *Mammillaria busonii* is hardly headline-grabbing, wallet lining news (Lewin). Instead it serves as a test of the vetting ability of the publishing editors, and failing that, the critical faculties of their readership. The point is that the joke is found out, and in doing so it

helps to either test the process of scientific scrutiny or expose the flaws in the system so it can be better at detecting more ill-intentioned dupes in the future.

Such humour also has an ability to secure a kind of group cohesion in scientific communities and sub-communities. Jokes shared in laboratories, departments, campuses and across institutions help to reinforce the intellectual as well as social bonds that help define such in-groups (Bell 2010). This is a phenomenon that can be observed in many social units, from the circle-of-friends all the way to national and ethnic groups (Kuipers 2006).

This is why many uses of humour and jokes in science appear to those outside of the profession to be arcane and incomprehensible: they are not for people outside the target audience, and usually a great deal of knowledge of a subject is required to even understand the setup or punch line. So while the intent of the joke is purely humourous (Category 3), a high degree of science is retained in the joke in order for it to function.

Renteln and Dundes (2005) completed an intriguing study on this facet of science humour by examining the humour used among mathematicians. They highlight the fact that the level of subject-specific comedy has generated its own internal folklore, which in turn helps to define mathematicians as a group. In this case, and presumably in other scientific disciplines, the humour used acts as a touchstone; a common point of reference for the community using it.

The study also notes that while the humour does tend to affirm certain qualities popularly ascribed to the "geek" demographic, their light-heartedness simultaneously subverts the stolid impression of scientists - for example "Q: Why can't you grow wheat in Z/6Z? A: It's not a field." would not seem out of place in *The Big Bang Theory*'s portrayal of geeks.

Humorous witticisms may also serve to help outline scientific points in a fashion that become more memorable, and even more so when coupled with the few science "personalities" that exist in the field. Some even go on to enter the scientific "folklore" and are passed down generations of scientists, such as J.B.S Haldane's spirited quasi-

practical summation of the genetic basis of kin altruism[1]: "I would lay down my life for two brothers or eight cousins (Connolly and Martlew 1999).

Such feelings of playfulness are also seen in taxonomy, specifically in the area of binomials. While rules exist to standardise the naming or renaming of species (regulated by the *International Code of Zoological Nomenclature* and its equivalent codes for botanical and bacteriological naming), some scientists still manage to find ways of expressing their humour. *Abra cadabra* (a bivalve mollusc, now in the genus *Theora*), *Heerz lukenatcha* (a braconid wasp) and *Ptomaspis*, *Dikenaspis*, *Ariaspis*[2] among many others bear witness to this (Isaak 2002).

There is a counter-movement to these forays into humour, however. A common perception exists within science that over-use of humour can result in an undermining of the science that is being communicated. Application of comedy in a scientific medium is often perceived as incongruous and confusing, or even as trivialising the seriousness of the science (Alley 1996; Montgomery 2003; Blum, Knudson et al. 2006).

In some cases using comedy appears to be detrimental to the scientists involved. An analysis of article citations was conducted by Sagi and Yechiam (2008) that compared the number of citations of articles in two psychological journals that contained humorous titles with articles that did not. It was noted that the articles with humorous titles were cited significantly less than their straight laced contemporaries. The precise reasons as to why this might be so are unclear, but may be related to scientists' perception of the use of comedy as frivolous. Equally, however, such titles could simply be a turn-off to those seeking pure fact or raw data in their studies, or serve as a potential "red flag" indicating poor scientific writing. Humorous titles could be conflated with a subjective interpretation of evidence or personal style of writing that would leave strict scientific researchers unimpressed.

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[1] Kin altruism: A convention in evolutionary biology that states that altruism between individuals of the same species is more likely between closer relatives due to the presence of shared genes.

[2] All are jawless fish from the Devonian period. Remove the "-aspis".

The benefit of using comedy is more apparent in scientific outreach. Scientists willing to accept a wider role for comedy in academia may find popularity in certain niche groups, which in turn may help to advance science comedy and its messages into new areas.

The reach of an academically styled, "geek" brand of humour has grown greatly in the public sphere with the advent of a mass internet geek subculture (McArthur 2008). The often oblique catchphrases and in-joke, with origins on internet forums and video sharing sites, are increasingly becoming more visible outside of the digital realm through posters, t-shirts and other merchandise. In these, a reverence for science is often displayed in humorous form, with many comedic "memes" centring on scientific topics.

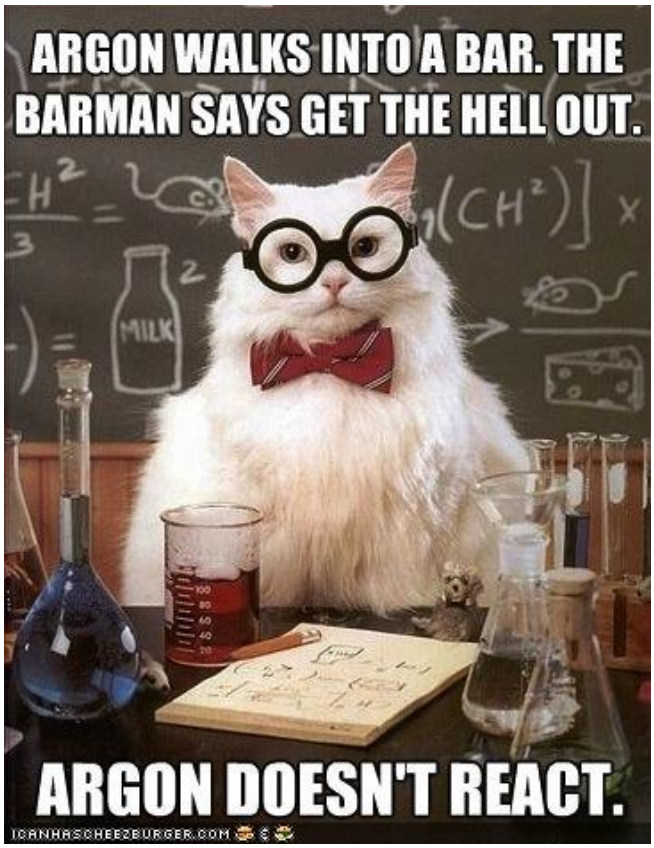


**Figure 1: "Chemistry Cat"**
http://knowyourmeme.com/memes/chemistry-cat#.TqjWL7LkY3s

Whether the memes take the form of a scientific riff on "lolcats"(*Figure 1*), a street talking appraisal of DNA Polymerase Beta or the campus humour of online comic strip "XKCD", the memes' widespread distribution in the public arena stand as testament to their popularity and perhaps to an appreciation of the scientific method itself (Beacco, Claudel et al. 2002).

Some scientists have managed to ride the wave of this ethos, particularly the journal the *Annals of Improbable Research* (itself a spiritual offshoot of the *Journal of Irreproducable Results*), which publishes bi-monthly reprints of the most (sometimes unintentionally) humourous

research papers. Their yearly event, the igNobel awards, seeks to draw attention to "*research that makes people **laugh** and then **think***." (Abrahams 2002) by awarding prizes analogous to those awarded at the genuine Nobel prize ceremony. Winners of the 2011 awards included "*Beetles on the Bottle: Male Buprestids Mistake Stubbies for Females (Coleoptera)*"(Gwynne and Rentz 1983), which outlined mating attempts by certain beetles on beer bottles; "*No Evidence Of Contagious Yawning in the Red-Footed Tortoise Geochelone carbonaria*" (Wilkinson, Sebanz et al. 2011) and a patent application for a wasabi-based alarm system (Goto, Sakai et al. 2009).

This approach from the more eccentric side of scientific investigation is one which can be replicated in a more formal mode of teaching. By using humour as a hook to gain the audience's attention and following up with a strong factual core, science communicators might establish a balanced and effective approach to scientific education.

# Chapter 2: Humour and teaching

> "*This precipitated a laugh. That's good, Tiffany thought; laughter helps things slide into the thinking*."
>
> ☐ Terry Pratchett, *I Shall Wear Midnight*

Science is generally seen by the public as a monolithic, stoic and robotically serious endeavour – bereft of emotional content. While it may be respected in terms of its intellectual and utilitarian merits, in many people's minds science remains at best a thing apart from normal society. As the last chapter demonstrated, this attitude is not representative of internal attitudes toward science, where humour, serving as an emotional buffer for hard science, is quite prevalent. Less widespread are attempts to integrate humour in the formal communication of science.

How is comedy able to aid scientific pedagogy? The answer to this question is multifaceted, and involves relatively disparate disciplines. This chapter will explore the potential benefits of humour on a number of levels: neurological, psychological and sociological. It will also explore the use of comedy in primary, secondary and tertiary education, and the possible advantages and pitfalls of its use in these contexts.

Medical observations through the late 20$^{th}$ century made a strong case for the benefit of humour in overall human health, supporting the old adage that "laughter is the best medicine". Since the anecdotal observations of Norman Cousins in the 1970's that a diet of vitamin pills and the Marx Brothers could be an effective coping mechanism for dealing with his debilitating degenerative disease (ankylosing spondlytis), there have been numerous articles and papers published that discuss the potential role of humour as a facet of holistic medicine (Cousins 1976; Provine 2000). These in turn have led to a number of empirical investigations on the subject. Various studies have indicated that the act of laughter serves to: boost the activity of the immune system (Dillon and Minchoff

1985; Labott 1990), increase endorphin production (Provine 2000), relieve stress (Toda 2007) and is effective as an analgesic (Cogan 1987).

These documented effects indicate that laughter has a significant impact on our physiological and psychological wellbeing which has implications for a wide range of social and professional constructs, including education. Indeed, within a specifically educational context, secondary studies have indicated that laughter can help facilitate the learning experience in the classroom.

Neurological analyses of the human brain during the state of laughter supports the idea that humour may help stimulate information inculcation on a physiological level. A laughter state actively engages both left and right brain hemispheres (Glenn 2002; Martin 2007). The dual stimulation potentially opens a neural pathway for memorisation by creating associations of meaning towards facts (Hogan 2007; Martin 2007). In other words, the pairing of "hard" learning with "soft" humour helps to contextualise both in the mind of the learner, providing an emotional (right brain) anchor to the logical (left brain) data.

The stress-reducing quality of humour eases anxiety and increases mental acuity through the production of catecholamine and adrenaline as a response to comic stimuli (Chiarello 2010) a factor that enhances the physical process of learning (Glenn 2002; Garner 2005; Martin 2007).

Psychology is also providing evidence of the power of laughter in learning environments. The field of "positive psychology" as put forward by Marin Seigelman explores the psychological roots of human happiness and wellbeing. For psychology, this is a change in epistemological tack. Positive psychology sees a shift away from psychology being concerned largely with a negative emotional continuum where there are countless well-defined diagnoses and treatments for mental ailments and reactions to negative stimuli. Reactions to fear and anxiety are important and well attended to, since they most often signal a departure from a safe status quo which may need to be rectified. Facets of happiness are less well defined and researched, and as such there is little data

on how these can be elicited in a practical sense (Morrison 2008). Since the formal definition of the field of Positive Psychology in 2000, empirical support for the hypothesis has begun to accumulate, albeit slowly, giving credence to the practical use of this strand of the science (Seligman 2000; Seligman 2005). This approach to personal and group psychology could have profound effects on formal pedagogy, which has traditionally had a focus on correcting negatives rather than reinforcing positives. Identifying and mitigating negatives is an easier task because they are more easily flagged by the human cognitive system as they trigger the same apparatus that recognises threats to survival (Fredrickson 2003; Morrison 2008). The benefits of a positive emotionally based approach to education does appear to have merit: study into positive psychology in educational contexts indicate that its application can increase students' enjoyment of learning, their hope for success and academic pride (Pekrun, Goetz et al. 2002). Humour, being an important facet of positive psychology, may have a significant role to play in this approach to pedagogy.

Given what is now known about the physical and mental properties of humour, a number of hypotheses have emerged relating to how comedy might be useful in an educational context. These include: encountering jokes in a formal setting confounds expectations and therefore attracts student's attention; humour acts as an environmental de-stressor, reducing anxiety over the task at hand and humour created through a good and appropriate joke can aid in establishing and maintaining teacher-student relationships (Morrison 2008; Roth, Ritchie et al. 2011).

How then can laughter be brought into a classroom? Combining comic elements with teaching and learning is something that many educators would approach with considerable trepidation, if at all. Pitching the level and tone of humour to stimulate engagement in a subject without the jesting becoming detrimental to the learning process can seem like an alchemical practice. Many teachers fear that the imposition of an emotional "wildcard" in the form of humour into an otherwise structured lesson plan could lay the foundations for a loss of focus on the subject at hand, perhaps even leading to a total loss of control (Bergen 1992).

Some manner of formalisation is required, and while it may not yield a step-by step guide on "how to be funny", some basic ground rules would help to pave the way for a more accessible and widespread use of humour.

Bergen (1992) has outlined four categories of humour use strategies as a result of observations in classrooms of various educational levels. The categories break down as follows: Performance Strategy, where a teachers' humourous performance sets the agenda and guides how comedy will relate to the lesson; Indirect Facilitation Strategy, in which humour is prompted via the selection of specific learning materials; Eliciting Strategy, in which humour is directly sought from the student to encourage their development of humour and an understanding of its related cognitive processes in order to improve their response and use of humour; and finally Respondent Strategy, in which the teacher actively responds (and where appropriate, rewards) the spontaneous use of humour by the student as a means of developmental encouragement.

Mary Kay Morrison (2008) outlines a more general approach to using humour, with a three-stage model styled "hook, line and sinker". The "hook" phase refers to the initial use of humour, which is deployed to capture and retain the attention of students. The "line" relates to the linking of information with the humorous emotional state, allowing the humour to act as a memory trigger – these being similar in nature to mnemonic associations triggering recall. The "sinker" increases opportunities for memory retention, where teachers can use humour to aid in the feedback process, reinforcing the emotional state-memory connection and aiding the "sinking" of information into long-term memory and aiding future recall.

While Morrison's approach is largely untested, the analytical ground on which it stands appears solid. Research indicates that: teachers utilising comedy in their teaching have a higher level of student involvement in their classes in both the logical and abstract information involved, there is a higher retention of information on the part of the students, and there is better student feedback for these teachers when they are compared with teachers using a standard approach to the curriculum (Kaplan and Pascoe 1977; Garner 2006; Takahashi and Inoue 2009). Teachers themselves have noted the above

effects, and have also reported that incorporating humour into lessons helps to create a more relaxed and focussed learning environment (Huss 2008).

Comedy need not end in the primary or secondary classroom. Indeed with the frequently less formal nature of tertiary education there may be even more scope for humour in colleges and universities.

Kher, Molstad & Donahue (1999) explore the benefit of using humour in a tertiary education environment, suggesting that incorporating comedy into so-called "dread courses" – courses normally shied away from by students (such as statistics) – improves both the attention and understanding of the classes as well as boosting attendance and lowering the drop-out rate. An article by Andy Field (2009) corroborates this finding, noting that the inclusion of humour in statistics courses attended by undergraduate psychology students managed to allay "maths anxiety" and motivational problems which have been linked to underperformance in classes. A course and accompanying book that Field authored, "*Discovering Statistics Using SPSS*" tackled these issues by counterpointing the statistical theory with case studies and data sets from unexpectedly bizarre sources: *"I found myself accelerating uncontrollably down an icy slope of ejaculating quails, oriental men with eels up their anus, ovulating lap dancers and fake vaginas filled with fake sperm"*.

Such unorthodox case studies fit with a more anecdotal style of relaying facts, which is consistent with Category 2 of the dilution model discussed in the introduction. The humour in this instance is used as a counterweight to the factual content of the education, coexisting at a roughly equal level. Viewed scientifically the data is simply that - data, but it exists concurrently with an emotional interpretation that tells a humorous story.

The use of humour as a component of storytelling was found, through student evaluation, to be one of the most effective facets of such a story-based approach to education. In an introductory course in biology, teachers at an unnamed US university framed information on the topic in a series of stories, some of which contained a

humorous element. Student feedback indicated that comedic stories and stories that related to real life experiences were the most useful to their studies (Frisch and Saunders 2008).

A comedic approach certainly seems to resonate with students' expectations of learning: A report by Epting (2004) shows that 96.6% of students, when describing their ideal teacher, would prefer a tutor to employ humour "often or occasionally". Garner (2006) further reinforces this view, adding that teachers and lecturers that incorporate humour into their teaching styles receive consistently positive evaluations from both their students and peers. As a paper by Lei, Cohen et al. (2010) puts it: "*Humor has the power to make instructors more likable, approachable, facilitate comprehension, increase attentiveness, improve creativity, and promote social relationships*".

Group cohesion of classroom members is also aided by humour, allowing the social bonds necessary to establish a trusting relationship between teacher and student, humour also encourages the creation of a successful and effective class dynamic (Pollak 1997; Tapper 1999). It confounds the expected roles of student and teacher by bridging the perceived divide between the two groups and allowing emotion into the experience of science as it is being taught (Lei, Cohen et al. 2010). This allows for a relaxed atmosphere in the classroom, which helps facilitate the positive environment required for effective learning (Weaver 1987).

Humour's enhancement of group dynamics and team building also translates into the development of professional units, particularly those involved in high stress activities. Chiarello (2010) describes how the use of humour while training undergraduate psychiatric nurses helps to maintain a positive relationship between students undertaking stressful procedures – a factor that correlated with what had been posited about the physiological properties of humour. Again, the humour here serves to counterbalance the "hard edges" of the training task at hand, a Category 2 dilution that serves to provide relief from the study without diminishing its importance.

Chiarello's paper makes note of an important caveat to the use of humour in this context: appropriateness. While the potential in humour for positive reinforcement and encouragement is great, it is a tool that should be used with care. Comedy used incorrectly could also have a detrimental effect on the learning process.

Lei, Cohen et al. (2010) make a thorough list of the ways in which inappropriate uses of comedy can derail an educational process, as seen from the perspective of instructors. These can take the form of degrading remarks made by students that are unrelated to the lesson being undertaken. The perception here is that including humour in the lesson may leave an uncertainty in the mind of the student as to the bounds of appropriateness, which opens the potential for this uncertainty over boundaries being exploited. As a result antagonistic humour may be employed, which naturally disrupts the desired positive class dynamic. This may be a common teething problem when introducing comic elements for the first time in classes unused to its inclusion.

Precautions should also be taken on behalf of the teacher to ensure that their humour is appropriate for their target audience. While some recipients may respond to more risqué forms of comedy, other groups may bridle at vulgarity, profanity, sarcasm, sexual humour and so on. In such situations the use of comedy could have the opposite of the intended effects, erecting emotional barriers to the teaching process (Torok, McMorris et al. 2004; Lei, Cohen et al. 2010).

Likewise care should be taken on the part of the educator to maintain an appropriate balance of humour to teaching content. As outlined earlier, the ideal goal for the educator is Category 2 of the distillation model, a roughly equal mix of comedic and factual content. Excessive use of humour may undermine the credibility of the educator, lead to a loss of focus on the lesson objectives, and leave students feeling self-conscious or even bored (Bergen 1992; Wanzer, Frymier et al. 2006; Lei, Cohen et al. 2010).

Sometimes a joke falls flat. A paper written by (Fisher 1997) documents the delivery of two public presentations about cosmology at a planetarium, one incorporating humour and one without. When participants were presented with a quiz on the

information in the presentation, those that were subject to the "serious" presentation gave more correct answers than the group that received the comic presentation. The authors postulated that the direct integration of comedy into the facts being disseminated may have acted as a barrier to the acknowledgement of the information. It may be that making the information itself humorous may undermine its credibility, as opposed to framing purely serious information in a comedic context. More research on the practical application of comedy in such scenarios is required.

Getting the mix right takes practice and potential practitioners of comedic education should have realistic expectations of their performance before embarking on a regular program of humorous education. Not all forms of humour will be compatible with a teacher's personal style – experimentation and finding what works on an individual basis is key to developing a dynamic, context-sensitive mode of humour that both tutor and student can feel comfortable with (Garner 2006; Wanzer, Frymier et al. 2006). Giving teachers (and scientists) access to and experience with comedic techniques can help them hone comedic and improvisation skills, find a working style and also prepare them for interacting with media and the public (Olson 2009).

While a comedic approach to pedagogy has still to gain wider recognition, the potential benefits could lay the foundation for a wide paradigm shift in the manner in which formal teaching is conducted in future. Taken as part of a part of a wider zeitgeist in which the media is increasingly utilising humour to communicate science and other factual topics, the scope of comedy in teaching can only grow. While more empirical observations are needed to confirm its value, the prospect of humour in the classroom continues to be one which should excite both teacher and student.

# Chapter 3: Into the media

*"My way of joking is to tell the truth. It's the funniest joke in the world."*

☐ George Bernard Shaw

*Note: Video and audio materials for can be found on Disc 2 of the accompanying digital media for this thesis (see page 56)*

Opportunities for including humour in science are, as explored in the previous chapters, available in a variety of mediums: in formal academia via published papers and presentations, and also in pedagogy. These modes work well for audiences already or partially versed in science but delivery of a comedic scientific message to a wider audience requires new approaches and modes of delivery. To a certain extent this is already occurring. This chapter will explore the inclusion of scientific topics in mainstream comedy, the use of Category 3 communications as a springboard into science, and what current comedy can tell us about the public's understanding of science and try to evaluate the effectiveness of these modes of communication.

Note should be made that in the absence of dedicated study on the use of humour in this medium, perceived efficacy in some cases is inferred based upon what has been observed in the previous chapters. Future in-depth study will hopefully yield more reliable expositions on the following case studies and their value in science communication.

Around the time of the 2008 general election in the United States, a number of political science papers were published on the subject of the parody news programme *The Daily Show* and its effect on potential voters. One paper by Julia R. Fox retroactively examined the programme's content during the previous 2004 election campaign, directly comparing it with that of the coverage of the same news topics offered by major US news networks. Fox found that the substantive information in each instance was the same – the

comedy “fake news program” was delivering an equal proportion of factual content as the legitimate TV news (Fox, Koloen et al. 2007).

In the same year the results of a Pew report stated that regular viewers of *The Daily Show* (as well as its sister programme, *The Colbert Report*) had the highest scores when tested about their knowledge on current affairs (Pew Research Center 2007).

Here then, is an example of a programme that manages to educate its viewership when its first objective is to be humourous. If the distillation model is applied to this scenario, *The Daily Show* conforms to Category 3: the programme uses factual information as a jumping-off point to humorously extrapolate and satirise the real-world information. The study (Fox, Koloen et al.2007) is not without its detractors: one other study found that such shows were less effective than news channels in delivering factual information (Kim and Vishak 2008). Taken together however, both studies show that viewers were still better informed through an entertainment-centric form of delivery than those that watch neither news nor parody. The latter study (Kim and Vishak 2008) also noted that comedy viewers are more likely to follow up on the news stories by looking online.

However, the main thrust of *The Daily Show* deals with socio-political current events. Science coverage receives the least amount of attention on the show – science and technology news accounted for around 3% of the show’s coverage in 2007 (Pew Research Center 2007). Even so, established scientists have been quick to praise the show’s accuracy and its ability to connect with a wide audience (Vergano 2010).

This raises a key issue: if comedy programming such as *The Daily Show* can be used to disseminate information on political topics, can the same be done to communicate science?

The principles behind such an approach to science education have their basis in the notion of non-formal or tangential learning: there is a clear link between interest and learning (Tobias 1994), a principle that has the capacity to open up new areas of interest and create a new and more extensive audience for the science communicator. Tangential

learning suggests that when information is presented in a context that the audience already finds exciting and engaging, a proportion of that audience will self-educate on the subject (Portnow 2008). In other words, with informational prompts within an entertaining context, audience members may seek out further information on their own, as Kim and Vishak demonstrated with viewers of *The Daily Show*.

Writing in an opinion column in 2008, games designer James Portnow discusses the potential of tangential learning by exploring an extant example in video games:

> "*Do you know how many RPG* [Role Playing Game] *gamers who have never gone to Temple know what the Sephiroth is simply because the Final Fantasy team decided to name a character after it? If .1% of their audience discovered what it is they've just facilitated the learning of 10,000 people*."

Given Portnow's surmise and Fox and Kolean's findings we can postulate that the tangential learning principle may operate with the most obliquely subtle reference or aside in the main narrative of nearly any media. The audience, intrigued by the micro-exposure to the referred concept, becomes motivated to learn more and thereby enriches their knowledge of the reference's source as well as opening this new avenue of learning. And what works for a religious allusion in a game may work equally for scientific allusions in comedy.

How then, can comedy utilise science? Traditionally at least, science has been a ready source of public humour, but not in a way that most scientists would find useful. Science and its practitioners have a definite otherness in comparison to the lay public – they have their own mode of language, work practice and social conventions that have and continue to be easy targets for mockery (Kilbourne 1996). But parallel to this has also been a comic appreciation for science, acknowledging and celebrating its idiosyncrasies and achievements.

Some of the more catchy examples of this interpretation of science may be found in song. The work of comic songwriter Tom Lehrer was influenced to some degree by his previous career as a mathematician, and the academic ethos in which he worked. Few

chemistry departments are unaware of *The Elements*, a patter-song listing of the (then) known elements sung to the tune of Gilbert and Sullivan's *Major General's Song*. The song has become strongly associated with Lehrer amongst the general public, and its popularity persists to this day: a recent notable reference to the song occurred when it was sung by *Harry Potter* actor Daniel Radcliffe in a 2010 television interview.

Likewise, the 1950's variety double-act of Flanders and Swann also paid tribute to science in song with *The First and Second Law.* The song (first recorded on the live album *At the Drop of a Hat)* consists of a jazz number that outlines the first two principles of thermodynamics:

*Heat is work and work's a curse*
*And all the heat in the Universe*
*Is gonna cooool down 'cos it can't increase*
*Then there'll be no more work and there'll be perfect peace*
*Really?*
*Yeah - that's entropy, man!*

Humour arises from the unexpected juxtaposition of the textbook description of physics with musical rhythm and jazz slang. In this instance neither the factual content nor the stylistic presentation is compromised, with the song serving as an archetypical example of a Category 2 presentation of science and humour.

The tradition of humorous science songwriting has persisted into the 21st century. In 2009 the Alt-Rock band *They Might Be Giants* released an album aimed at children titled *Here Comes Science*. The record contains 19 songs, each of which explains an element pertaining to science and technology. Humour again is presented through the combination of science and the musical style involved as well as in the framing of the topics by the lyrics. Coming full circle from Tom Lehrer, the album contains a song titled *Meet the Elements* which again lists the elements:

*Neon's a gas that lights up the sign for a pizza place*
*The coins that you pay with are copper, nickel, and zinc*

*Silicon and oxygen make concrete bricks and glass*
*Now add some gold and silver for some pizza place class*

Is there an advantage to using musical comedy to communicate science? There is much evidence to support the claim that music acts as a facilitator of learning and memorisation, working in much the same way as mnemonic devices (Moore, Peterson et al. 2008). The organised structure of rhythm, melody and lyrics helps to frame information in a way that assists learning and retention (Kilgour 2000; Reisberg 2001). When information that might not have an apparent linking structure is placed into the structured mental frame of a mnemonic, the inherent organisation helps the learning process. The colours of the simplified spectrum may be hard to remember on their own, but given the context of Roy-G-Biv (among other mnemonics) it prompts the order of colours and subsequently becomes very easy to recall. The same is true of learning the tune and words to a song – each help to aid the memory of the other, and consequently the retention of any information that may be contained within either element. The more easily the mnemonic is learned, the more easily it is later recalled (Rainey 2002). Combining this potency for memorisation with the positive memorisation effects observed in humorous learning, as explored in Chapter 2, could create a potent pedagogical approach that would surpass more traditional approaches to science communication.

In the media as a whole, songs dealing in scientific topics are relatively scarce. Much more prevalent, particularly in the age of YouTube, is the presence of easily distributed video content. No longer delivered by television networks, this video delivery method can be simultaneously and globally accessed from nearly every conceivable outlet: streaming media on the web, downloads for mobile devices, screened in public places, and even viewed at home on the couch. The opportunities for science based programming to reach their potential audience has never been greater, but conversely the wealth of competing entertainment in a fragmented market presents another barrier – a barrier that a comedic approach can overcome. Some television programs are ahead of the curve in this regard, providing good case studies for how future shows may be able to

balance factual content with the levity of humour in order to create a "soft" entertainment that also educates.

One of the most frequent uses of comedy in scientific programming comes from children's television. Comic techniques are as useful in this context as they are in classrooms, as discussed in Chapter 2. Many children's science shows have incorporated a large dose of humour, whether they be in the zany characters and slapstick of the US's *Beakman's World*, the enduringly offbeat style of Bill Nye, or the explosive spectacle of the UK's *Brainiac!*

Less utilised is a comedic approach in adult science programming. Modern science documentaries have sought to add levity by introducing established comedians and comic actors as foils to a scientific co-host. Steven Fry worked opposite zoologist Mark Cawardine in *Last Chance to See* and *QI* veteran Alan Davies with mathematician Marcus du Sautoy in the BBC Horizon documentaries *How Long is a Piece of Strin*g*?* and *What Shape is the Universe?* These tend to fall into Category 1, with the hosts acting as the comic everyman to add light-hearted asides to the main factual thrust of the documentary.

Other documentaries take a more humour-orientated approach to the facts. One such example is the BBC's *The Mark Steel Lectures*, an educational history programme which ran for three series between 2003 and 2006 (themselves adapted from an earlier radio show) and features comedian Mark Steel as he summarises the life of a particular historical figure.

The programme's humour arises both from Steel's turn of phrase and the context in which the historical events are depicted – often re-enacted in a modern context that simultaneously lampoons "straight" re-enactments in other documentaries as well as anchoring the history within the world in which the viewer exists. Steel's commentary on the facts as presented also provides Steel with the opportunity to find their funny side. In an episode on the life of Charles Darwin, Steel explains the notion of Lamarkian

evolution (the notion held previous to Darwin that traits can be acquired and passed on during an organism's lifetime):

"*In other words, Lamark imagined the first long-necked giraffe saying to the other ones*, 'Hard graft mate, that's how I got this, eh? Getting up at half past five every morning. Doing two hours' neck stretching before a ten-hour shift at a banana tree'".

The series' success both as an educational product (the programs were produced by the UK's Open University) and as an item of entertainment again comes from a careful balancing of the factual content with the humour so that they remain on an equal footing. In a typical episode, the facts act as a setup for a joke which both reinforces the educational thrust, and paves the way for the next fact. This in turn informs the next joke, and that process moves the programme along.

Marine biologist turned filmmaker Randy Olson opts for a similar approach in his film *Sizzle: A Global Warming Comedy*. Here, however, there is a more obvious demarcation between the comedic and scientific focuses of the film. A mockumentary "behind-the-scenes" narrative is established in which Olson, his fickle producers and mouthy cameraman serve as ciphers for the audience and their questions, which serves to set up real interviews with climate scientists and sceptics. At these junctures the action follows a more traditional interview style and factual analysis before the characters interject with their own comments (to the surprise of the interviewees) and the two styles of filmmaking meet head-on. As a review for the film in *Nature* puts it:

> "[it is a] *gag that the film turns into a point about scientific communication: when you ask dumb questions in everyday language, scientists suddenly start talking like 'normal' people*." (Marris 2008)

The jarring and unexpected nature of this mixing of straight documentary tropes with comic drama creates a more engaging viewing experience because of its novelty. Instead of a weighty intoning of the facts as in other documentaries, the science (and its practitioners) are put on the spot in the social world in which the audience lives. This

playfulness of tone has the quality of a one-two punch: the humour breaks down the audience's expectations about the science before the information is delivered.

Another approach is utilised on radio, in BBC Radio 4's programme *The Infinite Monkey Cage*. Here a classic double-act of straight man/funny man is used to play the science off the comedy, and vice versa. In this instance the role of straight man is played by physicist and science populariser Prof. Brian Cox, with comedian Robin Ince as his humorous counterpart. The shows explore a specific topic related to science (ranging from recent science stories in the news to more outré subjects such as time travel) with Cox and Ince's observations stimulating an appropriate and apt response from each other. As such the programme achieves a back-and-forth repartee that gives a naturally equal weighting to both science and comedy (Category 2). The hard science mixed with irreverent humour in the show has proved enormously successful in terms of live and podcast listener ratings, and at the time of writing the programme has been recommissioned for a fifth series.

This effect of "softening" science with comedy on the viewer is amplified when used in a Category 3 environment – as the content is primarily composed of comedic subject matter. Science can be "sneaked in" to such programming and not only informs the viewer, but enhances the comedy at the same time.

Popular prime time cartoon *Futurama* has made use of this method of science communication on several occasions. In the episode *A Clockwork Origin,* regular character Professor Farnsworth is challenged to provide evidence for the descent of humanity (Fig 2). A simple listing of the transitional fossils of hominid apes provides an amusing way of showing both the advances of modern palaeontology and the weakness of the "god of the gaps" argument.

Another earlier episode succinctly explains the science behind global warming by parodying 1950's public information films. In the episode (*Crimes of the Hot*), the skit is used to establish the rest of the plot which involved cooling the earth with giant ice cubes. However, the clip was deemed of sufficient accuracy for Al Gore to include it in the documentary *An Inconvenient Truth*. Indeed it has been noted that the episode, first broadcast in 2002, was one of the first occasions in the mainstream media when there was a recognition of the modern problem of global warming as scientifically observed (Olmsted 2008).

**Figure 2 : Futurama: Farnsworth and transitional apes**

A more hard-edged brand of scientific comedy has also become popular in the past decade, characterised by aggressive humour and ridicule that is targeted at perceived pseudoscience and so called "enemies of reason". Perhaps the most successful example of this is the US show *Penn & Teller: Bullshit*.

The programme, featuring the eponymous illusionists, frequently takes aim at pseudoscientific topics (e.g. homeopathy, creationism, E.S.P) and gleefully debunks them with frequent profanity and nudity. The shock value to viewers accustomed to a more dispassionate approach to science is inherent in such an approach and is exploited repeatedly for comic effect. The tactic has proved a successful one, with the programme running on US cable for seven series over consecutive years. .

In the UK, a more subtle form of ridicule exists in the form of Dr. Ben Goldacre, whose "*Bad Science*" Guardian articles and book of the same name frequently names-and-shames pseudoscience and inaccurate science journalism with wry ridicule while

simultaneously informing their readership of the facts behind supposed miracle cures or the latest health scare.

The appearance of these scientific concepts in such a public and colloquial form (in marked contrast to formal or even popular science outlets) would seem to indicate an appetite amongst the public for this mode of presentation. The inclusion of science in such a format can play an important part in the social dissemination of scientific information (in a manner similar to other forms of informal information exchange): a good joke has the tendency to spread itself around in an oral tradition (Haythornthwaite 1996).

Just as comedy programming is able to present science in a "soft" format with mass appeal, so too is stand-up comedy. In the past few years, several journalists have identified a focus on scientific topics in the material used by several UK stand-up comics (Chivers 2009; Thomson 2009; Bell 2010). A deeper analysis of this phenomenon seems to suggest that the incidence of comics joking about science has increased over the past ten years (see Appendix 1). Whether or not this is accurate, the perception of such a growth is telling.

Moreover, many comedians tend to contextualise science in terms of personal experience. They explain this science within the context of comic everyday scenarios – scenarios likely to be familiar to both the comedian and their audience. Irish comedian Dara O'Briain, for example, tells a tale of dealing with pseudoscience in an ante-natal class, where he is told that "a tear heals better than a cut":

> *"What? That sounds counter-intuitive at best. I turn to my wife, who is a surgeon, and said 'really?'. And she said: 'No it fucking doesn't'".*

Such a short exchange may be light on statistical rigor or background reading, but it cuts straight to the heart of the issue, and also reinforces a respect for the scientific ethos: the alternative medicine espousing of a "natural path" is met with a sceptical yet funny disdain. By using the lightest of touches on the science surrounding the everyday issue and shifting focus to the practicalities, the stand-up manages to bypass the technicalities

that daunt many people about science, delivering them to the end-point of how it actually is involved in their lives.

The presentation of science in a stand-up setting is beginning to expand into more common forms of scientific presentation. In 2009 Robin Ince (of *The Infinite Monkey Cage*) hosted an alternative Christmas variety show titled *Nerdstock*, which mixed short lectures from academics such as Richard Dawkins, Simon Singh, Brian Cox and Ben Goldacre with sets from stand-up comics including Mark Steel, Shappi Khonsandi and Richard Herring. The show again gives equal weighting to both the science and the comedy and provides scientists with an entirely new means of connecting with the public. Audiences drawn for the comic talent may be introduced to new ideas, while the opposite is also true.

Other scientists are branching out into stand-up comedy as a primary means of engaging the public. Comedians such as Tim Lee, Matt Parker and Brian Malow have backgrounds in science (the former a population biologist, the next a mathematician and the latter a science journalist), but have since moved into stand-up full time, with their acts primarily focussed on science. By concentrating on the entertainment value of their knowledge, they are able to compete with their contemporaries while still managing to convey elements of science to their audience.

The success of such "science comedians" in finding and retaining audiences is a testament to the knowledge and showmanship they possess, and their ability to combine the two, but it is also a reflection of the spectators' knowledge of science to begin with.

Educational Psychologist Doris Bergen (1992) notes: *"When children laugh at violations of their cognitive expectations, it indicates that they understand what* should *be the result. A riddle or joke is funny only if both the expected and the unexpected meanings are understood"*.

The same is also true in adults – jokes require a certain amount of foreknowledge of the subject or expectations being addressed in order to be found funny. Therefore jokes

dealing with science most often need an audience able to comprehend the concepts the jokes are referencing.

In this light the increase of science jokes in stand-up sets informs us of the relative scientific literacy of the audience. Jokes that the audience don't understand or respond to would quickly find themselves weeded out of all but the most insistent comedian's routines. But the fact that audiences are accepting of an increasing amount of science comedy is clearly indicative of their comedic tastes and scientific knowledge. In short, the presence or absence of science in stand-up comedy can be used as a rough gauge of scientific literacy in the popular zeitgeist.

Popular comedy appears to be a new and promising outlet for science: it can prompt viewers to self-start their own learning process, package factual information in memorable and commercially successful formats, bring science to entirely new audiences and help to inform scientists about the public understanding of their work.

The incredibly divergent forms of these entertainments makes broad categorisation impossible, but allows for a vast number of approaches to science communication. The radiation of comic styles has the potential to suit all tastes and tolerances. Further experimentation with established and new formats will help to inform programme makers about the most effective ways to bring factual content to the public. This in turn may feed back into the academic establishment and help to construct new approaches in communication in that sector.

Future forays into the myriad brands of comedic science might allow for a much more scientifically informed population, one better equipped to make educated judgements on current and future issues. Today's audience can become tomorrow's advocates.

# Chapter 4: Tangled Waters

"*There's nothing worse than someone trying to explain why a joke is funny*."

☐ Randy Olson, *Don't be Such a Scientist*

The creative component of this thesis, the documentary film *Tangled Waters*, aimed to put some of the techniques outlined in the previous chapters into practice. While not every possible mode of humour was possible or appropriate to incorporate into the film, this chapter will outline the uses of comedy in that component, with a view to explaining their intended purpose and their place within the broader context of scienctific humour.

The film itself is concerned with the use of anti-shark nets around the Otago coastline. Over the course of the narrative, the history behind their use is outlined, and the arguments for and against their continued deployment are analysed alongside the biology of sharks and their cultural impact upon humans.

From its inception, the overall approach toward the documentary was to utilise a much higher proportion of humour than similar shark documentaries (broadly Category 2 as opposed to Category 1 in terms of the distillation model). The perception of other "shark docs" was one of straight-edged seriousness[3], with little to no room for levity in their content. The decision to move away from this model helped to establish a "unique selling point" for the finished product – a film that would stand apart on a tonal level from other documentaries dealing with similar subject matter. This very difference serves to distinguish the film for the viewer by confounding their expectations, seeking to subvert established tropes for comic effect.

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[3] Films such as the *Blue Water, White Death* (Dir. Peter Gimbal, 1971), the BBC's *Great White Shark* (Dir. Paul Atkins, 1995), or *Sharkwater* (Dir. Rob Stewart, 2006)

The film begins on such a note, by parodying a Hollywood trailer/Blue Chip documentary style in which a deep-voiced, sonorous narrator intones over a Jaws-esque underwater POV shot that sharks are "an unstoppable force of nature". This is quickly turned on its head as a staged shark attack turns out to be the introduction to the on-screen presenter, Thom Adams, and sets the tone of the film (Fig.3).

**Figure 3: Presenter Thom Adams's big entrance**

The use of a presenter provides a focal point for the humour, and helps to delineate its boundaries – Thom acts as an authoritative yet comic voice, allowing later interviews to exist independently of the comedic aspects of the film, thereby preserving their integrity as communicators of key information. An alternative approach can be seen in the aforementioned *The Mark Steel Lectures* in which presenter Mark Steel acts as both the communicator and joke teller for the programmes.

The subject established (with comedic bluntness: "This is a film about some sharks"), the film introduces its setting as the beaches of Dunedin. Thom appears on camera again, this time wrapped in a towel, an unspoken comic reference to his previous appearance in the sea. His dialogue again parodies the audience's expectation of the news reporting style, referring in overstretched metaphor to the perceived menace of shark attack: "a shark shaped shadow, a shadow in the shape of a shark".

Vox pops then highlight people's opinions on how safe they feel vis-a-vis sharks concluding on a comic note as beachgoer Tom Gampesle points out the lack of sharks visible in the immediate vicinity. Comedy here arises from the matter-of-fact way in which the threat of sharks is dismissed in a Kiwi vernacular, which differentiates the film from the normally formal language of most documentaries and establishes further uses of local terms.

The shark species of the Otago coast are then listed, (01.45) pausing to make note of the use of Tope (*Galeorhinus galeus*) as a basis for fish and chips. Here we deliberately subvert the expected behaviour of an authoritative presenter: instead of clearly enunciating this information, Thom speaks with a mouth full of fish which necessitates the use of subtitles.

The information resumes as the narration lists in a formal documentary manner the larger shark species found in the Otago area. This serious tone is broken as the narration becomes casual again ("Generally there's a few sharks in the area, is the point here"), making light of the preceding convention. By this point the precedent of a subverted authorial voice is well established, making the audience accustomed to a presentation style that employs both a formal and more relaxed voice when appropriate. This approach allows the presenter to communicate on both sides of the fence, performing both towards and against established convention. The ping-pong effect of these shifts in tone serve to retain audience attention, as outlined in Chapter 2 (Morrison 2008; Lei, Cohen et al. 2010).

As the Great White Shark (*Carcharodon carcharias*) is introduced along with its history of attacks in the Dunedin area, the humour takes a back seat in order to avoid inappropriate flippancy in dealing with the most tragic elements of the story. These reprieves from humour also operate by allowing the audience a "rest", and help to highlight the humour upon its return. This correlates to the observations in Chapter 1 where comedy serves as a punctuation to break down information into more manageable segments (Alley 1996; Kher, Molstad et al. 1999).

The next humorous punctuation point occurs during Barry Watkins's description of his shark attack. Watkins's inarticulate responses are allowed to run longer than a usual documentary sound bite, which comically underscores his failure to describe these events while simultaneously highlighting his humanity through his understandable inability to communicate the horror of this life changing attack. The factual description of his injuries is given a humorous counterpoint by the narration that rephrases Barry's dire situation without overstating the negative aspects of it: "Generally, it was looking like a bad day

for Barry". This approach is repeated after Watkins's recounting of his escape from the situation, with the narration emphasising the sheer luck of the evasion using a rule-of-three[4] escalation: "*It was an escape luckier than scoring a try from midfield. Blindfolded. With a Fabergé rugby egg*."

The story moves on to addressing the establishment of shark nets as a response to the 1960's Dunedin shark attacks (05:24), with a deliberate misunderstanding of the purpose of a shark warning bell at St Clair beach. This misinterpretation serves as a segue into the use of nets as a further step in the protection of the beaches, and allows the film to move easily onto the next segment.

The first act of the film concludes with a mock ending, which sarcastically posits that the shark nets have been a complete success with no criticism, thereby negating any reason for the film's continued existence. Thom breaks the fourth wall [5] by calling for a credit roll, before being stopped by the first voice of dissent. This sequence again plays with the audience's expectations of the documentary format, leading them to ask the questions that will eventually be asked and answered in the film. The sequence also alerts the audience to the fact that in this film the unexpected is to be expected. The joke also acts as a bridge point between the establishment of the nets and their subsequent criticism, again allowing for an amusing and diverting rest point before continuing to the next topic.

**Figure 4: Animated visuals counterpoint the narration**

Subsequent to the introduction of John Darby, a short animated sequence (07.30) (Fig. 4,) begins to illustrate the comparisons between

[4] Rule of three: A principle of writing that suggests that lists of three are more satisfying than other numbers. e.g. Tom, Dick and Harry.

[5] The Fourth Wall: refers to the deliberate acknowledgement of the audience or self-awareness of a piece of media. The term refers to the "fourth wall" that forms the view that theatre audiences look through.

the Dunedin shark nets and similar nets in Australia and South Africa. While the narration in this section is straight information, the visuals are presented in a fast and frenetic style that serves as both a visualisation of the concepts being spoken about and as a humorous counterpoint to them. The section in which a net is quickly filled with pictures of species known to be taken as by-catch are an accurate representation of the statistics logged by the New South Wales shark meshing programme (Paterson 1990; Green, Ganassin et al. 2009). Humour arises from the cartoony animation and sound effects and its escalation from fish to whale. The visualisation has a softening effect on the initial impact of the information and helps to support a more impartial approach to what could be considered to be controversial information.

Thom Adams's reappearance onscreen briefly addresses the poor record keeping of the Dunedin City Council's netting program, gleefully over-stretching a metaphor by acting it out on camera. Referring to the records as "sloppier than a melted ice cream", Thom proceeds to lick a melting ice cream in his hand, which duly falls with a splat onto a copy of the records themselves. The joke itself contains no primary information, but is an extreme distillation of information that would otherwise have taken much longer to explain. In this sense the joke is firmly cemented in Category 3 in terms of the distillation model, as it uses humour to convey the subsequent social value of the information it concerns, rather than the information itself.

A Category 2 use of humour is used in Thom's next piece to camera (09:26), where he holds up chocolate fish as a visual representation of the Great White Sharks purported to have been caught in the Dunedin shark net. This conflation of a children's Kiwi icon and a dangerous predatory animal is a deliberate invocation of cognitive dissonance: the two concepts have a common link in fish, but are oceans apart in reality. Here the information is accurately but humorously depicted onscreen in a way that informs the viewer, while simultaneously presenting them with an unlikely association of symbols.

Moving to discuss the efficacy of the nets in more detail, a piece of visual humour is deployed that non-verbally raises the issue of subjective viewpoints. Walking away from camera with a tape measure, Thom shows the audience the length of the 100m shark

nets. From the initial ground-level angle the distance appears to be quite significant, but the shot then changes to become very wide and high. From the new vantage point, the viewer can see how the initial length is dwarfed by the totality of the beach area. In so doing the pair of shots illustrate that from one viewpoint the nets are large and a satisfactory protection, but from another they are comically inadequate.

The fourth wall is again humorously broken during an underwater shot of the nets themselves (10:30). As the camera displays the holes in the nets, the narration points out that there are "holes a cameraman could swim through". This break with the convention of the camera crew as invisible observers serves up another unexpected incongruity while simultaneously providing a sense of the scale for the hole in question to the audience.

The section ends with another visual gag, with Thom again delivering a piece to camera while waist deep in the sea. He questions what would stop a shark from swimming up to him, as a shark's fin cruises past in the background. The joke is essentially a throwaway visual gag: no new information is communicated and the set-up for the next section would be the same without the gag fin. But coming after a longer "serious" section, the fin serves as a light relief for the vigilant viewer glancing away from the presenter's eye line.

A short vox pops sequence leads to the longest comic scene in the film: "Pie-Based Analogy Time" (11:09). The overly specific title card announces the humorous intent to the viewer, which is confirmed by the approach of the presenter. Thom is now in a kitchen, where he cuts up increasingly small portions of a pie, another use of a Kiwi icon, to provide a quick visual comparison between the probability of shark attack and other more likely, and sometimes bizarre, accidents. The diminishing likelihood is emphasised by Thom's use of tools to manipulate the pie: from knife to fingers to tweezers. Like the earlier tape measure shot, this use of visual comedy serves to frame the underlying information in an easily comprehensible form. By equating probability with increasingly unsatisfactory servings of food, the viewer is supplied with a Category 2 interpretation of the science that remains true to the source material. The last gag in the sequence ("I'm

hungry") serves as punctuation, signalling the sequence's end and setting up the final post-credits action.

Returning to the beach, the previous topics of shark net efficacy and probability are united in a comic set-up that posits that a similarly inefficient net could be used to prevent being attacked by dogs (12:00). Thom, after setting up such a net is immediately set upon by an unlikely assailant: a border collie (Fig. 5). The preposterous subversion of another cute Kiwi icon serves to comically ridicule the perceived protection afforded by the nets in a mode similar to that used by Penn & Teller or Ben Goldacre (Chapter 3).

**Figure 5: The face of statistically probable terror**

The next sequence pokes fun at another trope of investigative documentaries, in which the presenters are shown to travel to the next item in their stories (13:15). Thom is shown arriving at a sushi bar to find out more about the controversy surrounding shark nets, before concluding that there is nothing to be learned – all the interviewees are elsewhere. The absurdity of the action underpins the humour. The action could just as easily have proceeded directly to the next interviews, just as in the documentary style being lampooned, but the sequence of travelling in both instances allows for another Category 1 "breather".

Members of the Dunedin City Council now hold forth on their support and opposition to the nets (13:38). Humour arises from Councillor Lee Vandervis's response to the suggestion that the presence of the nets and a lack of attacks are linked. The

*reductio ad absurdum*[6] of his extrapolation of causality is accurate in its logic whilst allowing for humour through hyperbole.

The film goes on to offer its own absurd extrapolation, while touching on the issue of alternative shark deterrents (15:00). Noting that most options are too expensive to be viable, the film proposes and instantly dismisses another possibility, enacted in a quick shot of Thom insanely shooting a gun at the sea. The ludicrous exaggeration quickly addresses the absurdity of killing sharks in great numbers, whether by net or by the behaviour of action movie madmen.

A piece to camera is then seated in a visual gag, whereby Thom delivers his lines while entangled in a net. The situation is a practical application of a Category 2 delivery: the dialogue is presented with all seriousness, while the visuals are dedicated to humour. A slapstick note is used as a device to deliver the audience to the next scene.

The issue of the money spent on the nets is then emphasised, with a cutaway to the presenter rolling on a bed of money used in place of a comparison to other expenditures – another option considered. The use of this comic aside provides a visual indicator of the expense rather than a data-based one: the audience can already think of what they could spend $38,000 on.

The film enters its third act on a serious note (15:55). The by-catch of Dunedin nets (as opposed to their foreign counterparts) is examined with solemn interviews, the tone of which is later lifted with the introduction of Councillor Kate Wilson and the Mosgiel suburb's "Hollywood" sign. This is followed by another animated segment (17:13), which examines why sharks are a necessary part of the marine ecosystem. Comedic wordplay in the narration coupled with the cartoony sound serves to present these facts and maintain a stylistic continuity with the previous animations in the film.

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[6] Reductio ad absurdum: (Latin: "reduction to the absurd"). An argument that disproves a proposition by following its logical implications to an absurd outcome.

Thom returns to the sushi restaurant to again exploit absurdity to illustrate the irrationality of people's understanding of shark behaviour. By placing the notion that a predator hates that which it preys upon in a human context, the argument against its existence is made: generally humans do not hold grudges against their food.

**Figure 6: A film that most not be named**

Educator Steve Cutler poses the question of why people entertain a reasonable but irrational fear of sharks. As a response, a quick cutaway addresses the likely source of this fear by obliquely referencing the movie *Jaws* and its associated cultural impact (18.26) (Fig 6). The nonverbal allusion, complete with counterfeit poster, points out the source of the phobia and also suggests the possible legal implications of using a genuine poster from the film, again placing the documentary in a real-world context as opposed to the fiction presented by the "popular shark movie".

The humour is dispensed with during the sequences regarding the shark dissection and cage diving, so as not to undermine the positive associations with sharks that the sequences aim to present. A more humourous approach returns with the reappearance of the presenter onscreen as he improbably views wildlife from within the Dunedin City Centre (20:35). Here we exaggerate the point being made in the narration (that of Dunedin's proximity to wildlife), but also endeavour to simultaneously reinforce it.

The introduction of Dunedin Mayor Dave Cull (20:57) also uses a comedic exaggeration: the over-use of important sounding nicknames. While intended to be humorous, the emphasis also serves to highlight the importance of his role and the arguments being made. This helps to ease the change in tone from the previous scene to this sequence, which stays serious until the result of the council's deliberations is revealed.

Humour returns following the council's vote (23:00), when Thom appears for his last piece to camera. With a sincerity that could either be naïveté or a masked sarcasm, the presenter outlines a wish for a place where people might swim in safety. His closing statements are immediately followed by the solution to his question – he moves to reveal a salt water swimming pool. The sequence underlines the ludicrous nature of the shark net problem as a whole – the solution has been extant for some time.

The film moves to its coda, but not before some final humourous twists – one to remind the audience of how rare shark attacks are by referring to the dog net sequence seen earlier (24:00). The credits then begin using a pun on the French word for end as seen at the end of old movies: "FIN". Finally, a quick post credits sequence leaves the audience hopefully amused as Thom reappears to claim a piece of pie – a final reminder of the facts associated with it from the earlier 'pie' sequence.

Humour is integral to *Tangled Waters* but for the humour to work the viewers need to understand and recognise the formats and styles being spoofed, the metaphors used and the references made. Stray too far from what the audience can easily identify and interpret and the humour will be ineffective. The humour is couched in as broad a style as possible, although slanted a little towards the New Zealand audience in terms of its references. This emphasis may be reviewed and changes made in a forthcoming international cut of the film.

Making the film gave us an insight into the difficulties that can be encountered when combining science and comedy. Initially the topic did not appear to lend itself to laughter. Careful research and organisation of the available information was required in order to find the potential for levity. In the case of *Tangled Waters* some of the humour arises from the actions and reactions of people in response to sharks and shark attacks, rather than from the core subject itself. This is perhaps most prevalent in the interviews present in the film.

Careful selection of interviewees and the precise structuring of their interviews was the key in allowing any natural levity to come to the fore. Establishing a rapport with the

interviewee ahead of the shoot during the research phase of the production allowed the subjects to become more relaxed and candid in front of the lens. By carefully phrasing the questions and adopting a tone appropriate for the question and the personalities of the interviewees we believed that we maximised the chances of a suitably humourous remark occuring. In the film, these moments give the viewer a deeper understanding of the interviewees' personalities and their relation to sharks (e.g. Barry Watkins's loss for words, Peter Scott's building of a cage).

Of course we were not always successful. We often didn't find a funny interviewee or capture an engaging sound-bite. Many of *Tangled Waters*' interviews were discarded as a result. We learned that a way to combat this problem lay in critically assessing potential subjects before rolling on a final shoot. We endeavoured to spend time with the interviewee beforehand in order to gauge their personality or screen testing them for their behaviour on camera, or both.

A more easily controlled factor was the presenter. We had observed how effective stand-up comics could be when presenting documentaries, such as in *The Mark Steel Lectures* and *Last Chance to See*. We selected Thom Adams to present the programme because of his background as a stand-up comedian. Having an experienced comic performer in front of the camera increases the likelihood that humourous situations are likely to evolve during the shoot. The experience of comedians in working with crowds, their intuitive timing and versatility all help to blend the humour with the science being communicated. Using an established performer allowed the film to quickly create comic scenes that may otherwise have been difficult or impractical to achieve with a "straight" presenter.

Timing the inclusion of comedy in the film was also a key process in both writing and editing. As in both academic presentations and in the classroom, the film required a balance of comedy and factual content to ensure the former did not overwhelm the latter. At the writing stage this was assessed through round table meetings and read-throughs with the presenter. These gave us some indication of how lines and actions would look and sound in the finished product. During the editing stage feedback from peers and test

audiences also helped to guide the structure of the film and to gauge the suitability and effectiveness of comic sequences when they were juxtaposed with the serious portions of the film.

The presentation of factual information presented another opportunity to include humour. Many of the facts have a humourous aspect when viewed in a different context, such as the comparison of the Dunedin shark nets to its counterparts in Australia, or the strange-but-true statistics represented by our literal pie graph. Finding innovative ways of approaching the facts (as displayed in many of the programmes mentioned in Chapter 3) can be an important way to link straight information with a humorous delivery.

Crafting a comic narrative in a documentary requires planning and control, but the ability to recognise humour as it spontaneously generates is also essential. While the literature here provides a good framework for approaching science comedy, at many points during production of the film humorous moments were captured by chance: the timing of the presenter's first lines in the film occurred by accident, and these shots were used to replace a previous opening sequence that did not test as well. The ability to recognise and adapt for these spontaneous occurrences can greatly enhance the final product.

*Tangled Waters* attempts to create a different kind of shark documentary. Using humour hopefully lends the film an individuality that makes it memorable for audiences, and educates them about a topic not normally dealt with in this manner. In the creative component of this thesis, the film *Tangled Waters,* the theoretical information and wisdom of this the academic component have been applied. Our hope is to have made the creative component – the film *Tangled Waters*- an amusing and informing document dealing with a contemporary environmental issue.

*Tangled Waters* utilises approaches from each category of the distillation model in order to combine science communication with humour. Category 1 approaches tend to work best as punctuation points for propelling narratives and retaining audience attention. The fifty-fifty method of Category 2 humour, which *Tangled Waters* utilises the most,

balances information with comedy in order to present information in an accessible and digestible context that suits audiences that may not regularly view or be attracted to documentaries. Category 3 approaches science with broad comedy, touching on factual content lightly. *Tangled Waters* makes use of this category for a few short scenes, but the film's serious portions obviously do not fall into these categories. Category 3 approaches can be successful in reaching out to new audiences and intriguing them into learning more about the subject – an ideal format for bringing science into established entertainment media. However, documentaries should approach Category 3 methods with care to avoid appearing flippant or undermining their educational intent. Future science communicators may use these techniques singularly or in concert to create new audiences for scientific subjects, as well as providing established audiences with engaging and entertaining ways of experiencing the funny side of science.

# Appendix 1: Investigating the presence of scientific stand-up comedy in 2001 and 2010

Unpublished research conducted by Andrew Scott

## Abstract

Incidence of science in stand-up comedy has reportedly been increasing according to the media. Incidence of scientific humour was logged from DVDs for performances in 2001 and 2010 to ascertain if significant changes were occurring. While the number of scientific jokes logged did increase, they were not found to be significantly different.

## Introduction

Several news articles have noted a purported increase in recent years of the use of science as a topic by stand-up comedians (Chivers 2009; Thomson 2009; Bell 2010). This investigation will examine whether a significant increase in the presence of scientific themes has occurred in the past decade (2001-2010) by observing recorded stand-up shows of mainstream comedians.

## Materials & methods

Twenty recorded stand-up comedy shows were randomly selected from a list of DVD releases hosted by online retailer amazon.co.uk. Each title was assigned a number, and selections were made via random number generation. Ten titles released in 2001 were selected along with ten titles released in 2010.

**Table 1: DVD Recordings of sampled stand-up shows**

| 2001 | 2010 |
|---|---|
| Baddiel and Skinner - Unplanned Live | Bill Bailey – Dandilion Mind |
| Bill Bailey - Bewilderness | Billy Connelly – The Man |
| Louis CK - Live in Houston | Dara O'Briain – This is the Show |
| Otis Lee Crenshaw - Rich Hall Live | Dylan Moran – What It Is |
| Jim Davidson - Uncensored | Kevin Bridges – The Story So Far |
| Jamie Foxx - I Might Need Security | Lee Mack – Going Out |
| Eddie Izzard - Circle | Milton Jones - Live |
| Graham Norton - Live at Roundhouse | Ricky Gervais - Science |
| Henry Rollins – Up For It | Stewart Lee – If You Prefer a Milder Comedian… |
| Tommy Tiernan – Live | Tim Minchin – Ready for This |

Presence of jokes pertaining to scientific topics was recorded as defined by the following criteria: Biology, Chemistry, Medicine (including psychology) and Physics. When encountered, the instance of each joke was recorded, its subject matter noted and the time at which the joke occurred logged.

## Results

Data collected shows that there is an increase in the overall number of science related jokes in the sampled performances, with 2001 totalling 4 jokes as compared with 16 in 2010.

**Table 2: Recorded incidence of scientific jokes**

| | Number of Scientific Jokes Recorded | |
|---|---|---|
| | 2001 | 2010 |
| | 0 | 3 |
| | 3 | 0 |
| | 0 | 5 |
| | 0 | 1 |
| | 0 | 0 |
| | 0 | 0 |
| | 1 | 1 |
| | 0 | 2 |
| | 0 | 0 |
| | 0 | 4 |
| **Total** | **4** | **16** |
| **Mean** | **0.4** | **1.6** |

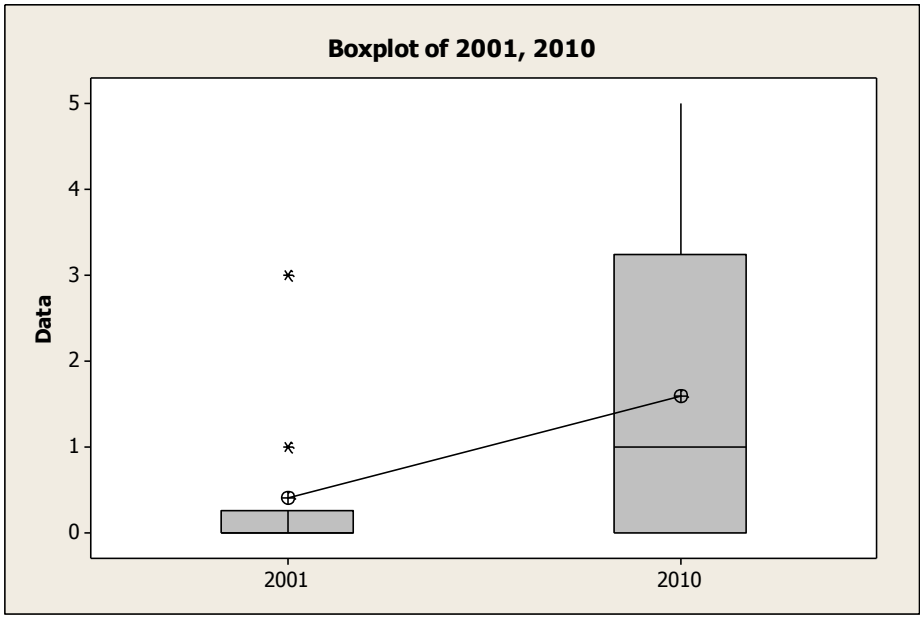
Data was tested for normality using an Anderson-Darling test, which yielded P-values of <0.005 and 0.018 for 2001 and 2010 respectively. As an independent set of samples, significant difference for the mean number of scientific jokes between 2001 and 2010 was tested in Minitab using an unpaired T-Test.

**Table 3: Two-sample T for 2001 vs 2010**

| | N | Mean | StDev | SE Mean |
|---|---|---|---|---|
| **2001** | 10 | 0.400 | 0.966 | 0.31 |
| **2010** | 10 | 1.60 | 1.84 | 0.58 |

Difference = mu (2001) - mu (2010)
Estimate for difference: -1.200
95% CI for difference: (-2.618, 0.218)
T-Test of difference = 0 (vs not =): T-Value = -1.83
**P-Value = 0.091** DF = 13

**Figure 7: Boxplot for T-Test between 2001 and 2010**




The P-Value for this test is 0.091, indicating no significant difference between the two groups.

## Conclusion

The results indicate that there is no significant difference between the two sample groups. Provided the two samples are symptomatic of the total comedic output of the subject years, the study appears to contradict the press observations of an increasing trend in scientific comedy over the past decade. Instead, it may be that media attention and reportage of scientific comedy is becoming prevalent – further study into the incidence of reporting should be a goal of future investigation.

The confidence interval of the T-Test is very close to the required 5%, which gives impetus for a repeated study with a larger dataset. The relatively small sample size in this instance may be a contributing factor to the negative result. More reliable data could be provided with larger data sets and sampling across each intervening year in the sample time range.

This study is limited to the presentation of comedy performances recorded on video and presented on DVD. While popular as a medium in 2001, titles were also released (sometimes exclusively) on VHS. Comedy on DVD in 2010 was also more prolific than in 2001. Follow-up investigations may wish to source other recorded media and live performances of unrecorded comedians in order to further enhance future data.

While the performances sampled include performers from several nations, the samples predominantly feature UK comedians. Future study should facilitate the sampling of more artists from outside of the UK, and may also sub-divide between individual nations to observe local trends in scientific comedy. In addition, while this study has focussed on English-language based comedians, further investigation and comparisons could be made concerning comedy in other languages.

# Supplementary Content

Disc 1: Tangled Waters

Duration:
25 min

Cameras Used:
Sony HDR-FX1E
Panasonic HDC-HS300
Canon 600D

Software Used:
Apple Final Cut Pro 6
Adobe After Effects CS5.5

Shot between:
December 2010 – September 2011

Locations:
Dunedin, NZ. Stewart Island, NZ.

Disc 2: Additional Media

Audio:

Flanders & Swann - Laws of Thermodynamics

The Infinite Monkey Cage - The Origin of Life

They Might Be Giants – Meet the Elements

Tom Lehrer - The Elements

Video:

Daniel Radcliffe sings *The Elements*

Excerpt from Dara O'Briain – This is the Show

Excerpt from Futurama – A Clockwork Origin

Excerpt from Futurama – Crimes of the Hot

The Mark Steel Lectures – Charles Darwin

Excerpt from Nerdstock – Robin Ince

Penn and Teller: Bullshit – Creationism

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