MEDIA SENSATIONALISM AND ITS IMPLICATIONS ON THE PUBLIC UNDERSTANDING OF SCIENCE

by

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ABSTRACT

Myths, misinformation, and sensationalism. These are common enemies that directly inhibit the public understanding of science. In particular, the media is often responsible for mishandling or otherwise misrepresenting scientific information, historically and presently speaking. Many sources can combat the public understanding of science through pseudoscientific means. This includes but is not limited to religion, the media, politics, or just simple hearsay. For example, Young Earth creationism is deeply rooted in Christian theology, but the beliefs hold no scientific basis. Yet, almost half of Americans still believe in Young Earth creationism. Another such example is anti-vaccination campaigns due to fears of autism-spectrum related disorders. In this case, falsified claims were given illegitimate credibility through the media, and the claims are widely and erroneously contentious to this day.

The purpose of this research was to investigate the relationship between an individual’s ability to dictate science from pseudoscience and their exposure to sensationalized media. Through means of surveying the university level population, relationships were drawn between how many pseudoscientific beliefs an individual may have versus how they interact with science and the media. The results of the survey showed a general lack of interest or care for science with more pseudoscientific beliefs, yet failed to draw a relationship between pseudoscientific beliefs and a sensationalized media.

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INTRODUCTION

Myths, misinformation, and sensationalism; these are just some of the natural enemies to the public understanding of science. In particular, myths and misinformation are brought about in large part by sensationalism. As technology advances, information is spread more and more rapidly through means of advanced communication. This represents a great direction for humanity, as an increasing amount of scientific discoveries have led to beneficial tools for survival via a better understanding of how the universe and everything within it functions. However, these aforementioned enemies of the public understanding of science have become more prevalent as the science becomes more complex. Humans are, and always have been, uninformed as opposed to being misinformed. It is important to establish this distinction – as the power of science starts to unearth answers to many ponderous questions, humans have become less *uninformed* and more *misinformed*. Targeting the source of this misinformation is the primary area of interest within this research. This misinformation is often delivered as pseudoscience, the natural enemy of science itself. It is believed that through means of media sensationalism, a large amount of misinformation is circulated among populations. Through means of gathering surveyed data, an attempt at drawing a link between sensationalized media and scientific misinformation was made.

Sensationalism itself is a tool used largely in journalism and media to sustain a following. Frequently, the use of sensationalism invokes a form of bias, and is usually at the expense of accuracy. This is not always the case, however. The standard definition for the word “sensationalism” is “the use of shocking details to cause a lot of excitement or interest[1].” Of course, such a definition allows for good sensationalism and bad sensationalism. The intentions of this research are to identify bad sensationalism – the type that is likely to cause misinformation. Therefore, all references to the word “sensationalism” from here on out will be assumed as the sort of sensationalism that takes a toll on accuracy of the information being conveyed, unless otherwise noted.

To better understand sensationalism and its effects on scientific misinformation, an in-depth look at the history of scientific misinformation that has caused public misunderstanding was explored. This literary review overlooks several different cases within recent history, such as the Measles-Mumps-Rubella vaccination controversy (among others). The goal of this literary review was to identify specific topics that were inaccurately of controversial nature. Topics such as moon landing conspiracies, anti-vaccination movements, and drug usage were observed and noted for further investigation. This information is present in the Literary Review chapter of this work.

The University of Central Florida Institutional Review Board (IRB) guidelines served as the basis for survey construction. The survey consisted of four sections: demographics, individual perception of science and the media, individual understanding of science, and individual perception of sensationalized media. All sections aside from the last section were designed based upon various previously surveyed data that has been shown to produce statistically significant results[2]. QuestionPro hosted and powered the survey. An in-depth discussion of this survey design is presented in the Methodology chapter of this work.

Statistical results were obtained largely through the utilization of stratified sampling using two-sample t-test hypothesis testing between various obtained results from the survey. The results largely fail to establish the hypothesized relationship between an individual’s inability to dictate science from pseudoscience and their susceptibility to sensationalized media. All assumptions, calculations, hypotheses, and results are presented in the Results chapter of this work. Further suggestions for investigation are presented in the concluding remarks.

LITERARY REVIEW

Overview

Several long-established cases of misinformation exist today, and are unnecessarily a point of serious contention within society. Some of these points may come across as obvious despite their insignificant contention (such as moon landing conspiracies), whereas others may be a point of serious political debate (such as global warming). Three major groups of pseudoscientific belief were identified.

The first group pertained to geophysical and astronomical pseudoscientific beliefs. These include subgroups such as Young Earth creationism, moon landing conspiracies, and denial of human influenced global warming. The second group pertained to biological pseudoscientific beliefs. The subgroup within this group was strictly about the beliefs about the efficiency of the human brain. The third group pertained to medicinal and drug related pseudoscientific beliefs. The subgroups included anti-vaccination movements and recreational drug beliefs.

It is important to note that within these topics, the source of the pseudoscientific belief on an individual basis may be from the media, political, social, or just from a general lack of understanding of science. Though the hypothesis was that a sensationalized media was a major contributing factor, several measures within the methodology were set up to identify as many contributing sources as possible.

Geophysical and Astronomical Pseudoscientific Beliefs

The first group of pseudoscientific beliefs likely had the most variability with the source of the belief. For example, Young Earth creationism, by definition, is the belief that the Earth was created by a deity in roughly 5,000 years[3]. This, is, of course, entirely a religious source. However, the subtopic of a moon landing conspiracy is generally sourced from mistrust of government. Furthermore, global warming is understood to be a combination of social and political contention[4].

Young Earth creationism.

The claim to Young Earth creationism is that the Earth is an estimated 5,000 to 10,000 years old. This claim, much like the rest of the claims presented in this chapter, has no scientific basis or reasoning. The truth, to the best understanding of the scientific community, is that the Earth is 4.54 ± 0.05 billion years old. This number is based upon radiometric dating of the oldest known materials found on the Earth and the moon[5]. Different methods of calculation have produced different results, however the order of magnitude and error remains largely the same.

The source of the claim of Young Earth creationism rests within religious documentation within the Bible[6]. Since the Semitic religions represent over half of the Earth's population, it's no surprise that Young Earth creationism beliefs could reach out to a significant amount of people. In the United States alone, a study by the Pew Research Center in 2011 reported that Christians made up over two thirds of the population[7]. Taking this into consideration, it once again comes as no surprise that the number of believers of Young Earth creationism is significant. A 2012 Gallup poll estimated that 46% of Americans were Young Earth creationists. In the same poll, 25% of all individuals with a post-graduate level of education still held such a belief[8]. In a nation built around freedom of the press and free speech, it does pose the question of whether or not sensationalism contributes to encouraging these pseudoscientific beliefs.

Moon landing conspiracies.

The field of politics largely clouds the ability to separate fact from fiction. In this particular case, however, there is a relatively small yet infamous population of moon landing conspiracy theorists. This is likely because, from a societal aspect in the United States and elsewhere, it might be seen as taboo to not embrace nationalism. Whatever the case, a 1999 Gallup poll estimated that about 5% of Americans believe that the moon landings were a hoax[9]. Of course, a poll from roughly a quarter of a century ago hardly does today's population justice. The significance of the selection of this poll, however, is that in 2001, Fox aired a television special entitled *Conspiracy Theory: Did We Land on the Moon?* Following this, skepticism of the moon landings rose substantially. Fox was seen to have sensationalized and promoted the claims of a hoax[9].

In the particular case of moon landing conspiracies, it has historically been observed that a sensationalized media can indeed, at least temporarily, promote or encourage pseudoscientific beliefs. This is why, despite making up such a small population, the inclusion is highly notable.

Global warming denial.

Very likely the most contentious of pseudoscientific beliefs, global warming is too often questioned as a valid scientific occurrence. A 2014 Pew Research Center poll showed that 46% of the public believed that, for one reason or another, humans do not contribute to global warming[10]. The reasons are largely diverse, however. Some believe that temperature changes simply are not occurring, while others agree that they are occurring but have nothing to do with humans.

What really hinders the scientific evidence from being brought to the surface is the fact that the science behind global warming is very easily not understood. The changes are small, spread out over large periods of time, and often complex as seen from the perspective of someone without a scientific or mathematic background in education. So, as a result, many of the opinions on global warming are developed from hearsay. This is where politics come into play. It is unfortunate, to say the least, that throughout the 1990s there was a strong movement among conservative political think tanks to challenge the legitimacy of global warming[11]. Politicians, supported through media, are empowered with the influence over their supporters.

Balancing an egg on the vernal equinox.

Sometimes, the occurrence of misinformation and pseudoscientific beliefs can be cyclical in nature. Through means of folkloric communication, some misinformation continues to find its way back into society. These myths and urban legends, too, are threats to the public understanding of science. One such example of cyclical folkloric pseudoscience is the case of ‘egg balancing’ on the vernal equinox.

As the urban legend goes, you can only balance an egg on the vernal equinox. This, of course, is a wild claim with no scientific support. Yet, every so often, historically, some variant of the claim presents itself. Despite being an utter disregard for simple physics, the claim has indeed caught on several times. One such time was in 1978, when a self-described ‘urban shaman’ Donna Henes began drawing crowds in the thousands in the heart of New York City for such egg balancing events during the vernal equinox[12]. Such a claim violates the simple rudiments of Newtonian physics. While superficially such a claim might be harmless, it is worth a second note to say that it is exactly the type of thing that is most alarming. This particular pseudoscientific belief violates fundamental beliefs. The practice of egg balancing on the vernal equinox frequently finds its way into elementary schools, potentially establishing misinformation into younger, more malleable minds[12]. With misinformation at a fundamental level, this is a particular example that expresses the importance to combat such pseudoscientific beliefs.

Biological Pseudoscientific Beliefs

Efficiency of the human brain.

The second group, biological pseudoscientific beliefs, was limited to just one subgroup – efficiency of the human brain. The claim is that humans only use a certain percent of their brain’s ability, and that the brain is largely inefficient. This claim is largely phenomenal and sensational, as it is an interesting yet inaccurate claim. The interest in this claim is that it has been largely present in media, such as the 2014 movie

Lucy. The most popular of the claims is that humans only use 10% of their brain capacity, and it is often misattributed to people such as Albert Einstein[13]. This particular claim does not necessarily originate from pseudoscience but rather simply from a myth. The appeal to authority and hearsay fallacies once again are present keeping the myth alive.

Medicinal and Drug Related Pseudoscientific Beliefs

The third group of pseudoscientific beliefs investigated were that pertaining to medicine and recreational drug usage. The first subgroup of beliefs were the anti-vaccination movements. The second was pseudoscientific beliefs on recreational drug usage such as marijuana and LSD, and how these drugs effect the user.

Anti-vaccination movements.

The Measles-Mumps-Rubella (MMR) vaccination controversy was very likely the original source of the large-scale pseudoscientific belief that vaccinations can cause autism or other autism-spectrum disorders. This particular claim sourced from an isolated, identifiable event. A researcher by the name of Dr. Andrew Wakefield was responsible for the falsified information. Not long after the publication of his research claiming to link the MMR vaccination to autism, investigations of the research showed manipulated information, conflicts of interest, and unethical practices by Wakefield[14]. Despite identification as a falsified claim, people still believe today that the MMR vaccine and other vaccines are responsible or linked to the development of autism or autism-spectrum disorders. In fact, the effects of anti-vaccination campaigns have been linked to the reemergence of some old school diseases[15].

The culprit, here, was hardly just Dr. Andrew Wakefield alone. Instead, the media was largely criticized for stirring the pot of misinformation. A study published in the 2007 *BMC Public Health* journal suggested that the media's role in the controversy gave illegitimate credibility towards Dr. Andrew Wakefield, stating that the evidence against the claim was as strong as the evidence for the claim. Similar studies within the *British Medical Journal* and *Communication in Medicine* came to the same conclusion, where the media ultimately gave unwarranted support towards Wakefield[16][17]. Once again, inaccurate reporting of a sensationalized claim has been historically observed as contributing to pseudoscientific beliefs within the public.

Recreational drug usage.

As diversity of claims come within recreational drug usage. Often times, the source of these pseudoscientific beliefs are as much personal as they are social. For example, a common misconception is that marijuana kills brain cells or causes brain damage. Such a claim would be what an opponent of marijuana usage would want the public to believe, and is often the standing point of anti-drug campaigns[18]. Thus, such a case can be seen as a claim sensationalized through media, yet entirely pseudoscientific. The pseudoscience goes in both directions with recreational drug usage, however. Individuals who use recreational drugs are more willing to believe that certain drugs might be able to have some form of spiritual high. This particular case shows how a lose-lose situation can be presented, both through media and through hearsay, where both sides of controversy can generate pseudoscientific beliefs.

METHODOLOGY & SURVEY OVERVIEW

Overview

After identifying several specific controversial pseudoscientific topics, the experimental design portion of this work began. A survey was created to investigate the relationship between a pseudoscientific individual and their exposure to sensationalized media. In this case, the term ‘pseudoscientific individual’ refers to an individual unable to differentiate real science from pseudoscience.

The survey was constructed borrowing questions from previous surveys shown to produce successful results. However, some questions were original. These questions and their results will be discussed section by section. The majority of the questions borrowed from previous surveys came from a Pew Research Center survey from 2013 entitled “Public’s Knowledge of Science and Technology[2].”

The survey was designed in accordance with UCF Institutional Review Board policies. All standards were met as per the Collaborative Institutional Training Initiative (CITI) to ensure ethical practices. Section one of the survey was the demographic section. It was used to gather standard demographic information about the individual. Section two was the perception section. It was used to gather how the individual perceive science and the media. Section three was the science section. It was effectively used as a sort of quiz to identify the individuals who held pseudoscientific beliefs. The final section, section four, was the media sensationalism section. It was used to gauge the individual’s perception versus the estimated population’s perception of how sensational, interesting, or otherwise scientifically accurate different topics were.

The final section was very much so an experimental section, where the entire section was original by design.

Section One: Demographics

The demographics section focused largely on standard demographics, including age, gender, level of education, area of education, level of religious activity, exposure to science in education, and exposure to media. The section was entirely straight forward, and consisted of nine questions. As per IRB standards, the only question that was allowed to be made mandatory was the question in regards to the age of the respondent. Table 1 depicts the questions or requests and their various available responses.

Question/Request	Response
Select your current age:	18-99 (increments of 1), Other (user input)
Select your gender:	Male, Female, Other
What is your highest attained level of education?	Some High School-PhD (8 levels in between), Other (user input)
What would you consider your primary areas of study to be? (choose up to two)	Arts, Humanities, Business/Administration, Physical Sciences, Life Sciences, Social Sciences, Engineering & Computer Science, Education, Medicine & Nursing, Tourism & Hospitality, Other (user input)
In a given week, how much time (in hours), do you devote to religious or spiritual activity?	I am neither religious nor spiritual, 0 although I am religious or spiritual, 0-3, 3-6, 6-9, 9+
Biology, chemistry, astronomy, physics, and environmental sciences are common educational science courses. How many of these subjects have you taken a course on during or after high school?	None, 1, 2, 3, 4, All 5
Biology, chemistry, astronomy, physics, and environmental sciences are common educational science courses. When was the last time you have taken an educational course on one of these subjects?	I am currently taking one of these courses, 1 year ago, 2 years ago, 3 years ago, 4 years ago, 5+ years ago
What level of news media do you encounter most, whether it be TV, internet, or radio?	Local News, National News (i.e. CNN, FOX News, MSNBC), Public News (i.e. NPR), Social Media (i.e. Facebook, Twitter), Other (user input)
What type or medium of news media do you encounter the most?	TV, Radio, Newspaper (paper or online), Other Online News Source (i.e. blog, discussion board), Social Media (i.e. Facebook, Twitter)

Table 1: Array of questions and their available responses in the demographics section

The intentions of the demographic section of this survey were to be used retroactively after establishing correlations in further sections. That is to say that there was no target demographic, but rather the intention was to investigate which demographic the results may or may not have fallen under.

Section Two: Perception

The second section was entitled "Background on Science and the Media." It consisted of eight questions asking the respondent to rate certain statements about science and the media based upon how much they agree or disagree with them. Five answers were available: strongly disagree, disagree, neutral, agree, and strongly agree. Table 2 presents the eight statements the respondents were asked to rate.

Rating Statement
I watch/read scientific outlets of media. (i.e. Popular Science, IFLS, Discovery, NatGeo, etc.)
I keep informed of some form of science or research routinely.
I see science as an important part of my life.
Science is accurately displayed in the news media and outlets.
Science is accurately displayed in TV and movie media.
Social media encourages hysteria and sensationalism.
Social media serves as a good means of exchanging scientific information to the masses.
Media outlets take accountability for misrepresentation or inaccurate reporting.

Table 2: List of rating statements presented within the perception section

The intentions of this section were, again, for use retroactive to results in the final two sections. This section was treated as a secondary demographic section, although the subject matter within it largely pertained to media and science in particular.

Section Three: Science

The science section of this survey worked much like a quiz. The intentions of this section were to identify each user by their respondent identification number recorded through QuestionPro based upon their number of pseudoscientific beliefs. Two subsections were presented in this section. One section was an entirely true and false section with 11 different scientific questions with absolute answers. Some of these statements were placed to find pseudoscientific beliefs, whereas others were placed to find lack of scientific knowledge. With these in place, it could be determined whether or not the individual simply did not know their science at all, or if they more likely genuinely held the pseudoscientific beliefs. Table 3 shows the first 11 true/false statements. The statements are listed in the order in which they were asked.

True/False Statement	Potential Type of Misinformation
An atom is smaller than an electron.	Incorrect Science
Man has set foot on the moon.	Pseudoscience
Glass is an ultra-slow moving liquid.	Incorrect Science
Man has set foot on Mars.	Incorrect Science
All radioactivity is man-made.	Incorrect Science
The Earth is thousands of years old.	Pseudoscience
The Earth is billions of years old.	Incorrect Science
The Earth is trillions of years old.	Incorrect Science
The most abundant gas in the Earth's atmosphere is oxygen.	Incorrect Science
Seasons on Earth are caused by Earth's axial tilt.	Incorrect Science
Humans use around 10% of their brain capacity.	Pseudoscience

Table 3: List of true/false questions and their potential types of identified misinformation if answered incorrectly

Each of the statements in Table 3 were carefully inserted with considerations in mind. Enough true statements were provided such that variability in responses was present. In the particular case of the three successive Earth age statements, adjustments were made when respondents answered true to two or three of the responses. The adjustment made was to the higher value. This conflict was placed intentionally so that all of the questions were not obviously targeting controversial topics and thus potentially alienating the respondent.

The second subsection took nine relatively more controversial statements into consideration, where perhaps more than one answer could be considered correct. The respondent was asked to rate the statement. Five answers were available: false, mostly false, unknown/neutral, mostly true, and true. Table 4 shows those statements, as well as their potential types of identified misinformation if answered incorrectly.

Rating Statement	Potential Type of Misinformation	Determined Incorrect Answers
The Earth's climate is changing due to human influence.	Pseudoscience	False, Mostly False
Vaccinations cause a higher incidence of autism.	Pseudoscience	Mostly False, Mostly True, True
Medications, when taken as prescribed, cause more harm than they do good.	Pseudoscience	True
Vaccines can cause adverse effects.	Incorrect Science	False, Mostly False
The brain is inefficient, and studies towards improving efficiency can help increase brain usage.	Pseudoscience	Mostly True, True
Smoking marijuana can affect motor skills and hinder knowledge retention.	Pseudoscience	True, Mostly True
The popular recreational drug, LSD, can burn holes in your brain.	Pseudoscience	Mostly True, True
The popular recreational drug, LSD, is permanently stored in the body once consumed. At any point in the consumer's life, it can be released into the blood stream, triggering an uncontrollable trip/reaction.	Pseudoscience	Mostly False, Mostly True, True
Caffeine can make kids jittery or hyperactive.	Incorrect Science	False, Mostly False

Table 4: List of rating questions and their potential types of identified misinformation if answered incorrectly

It is important to note that the decision to use rating statements inserted some level of subjectivity as to what answer was considered incorrect and what was considered correct. Another important note was that any answer of “unknown/neutral” was entirely disregarded, and considered the same as not answering the question at all. Table 4 also shows the incorrect answers as determined appropriate in data analysis.

Section Four: Media Sensationalism

The fourth and final section of the survey was the media sensationalism section, entitled “The Media.” The goal of this section was to gauge how exciting, interesting, and informative the respondent finds particular news article titles. A second subsection also asked the respondent to rate how scientifically accurate they believed specific movies of scientific and pseudoscientific nature to be. This section was largely original, which likely explains its failure to produce discernable results (to be discussed in the next chapter).

For the first subsection, 12 different headline article titles from national news outlets were randomly selected from various different news sources online or in newspapers throughout 2014. An original list of roughly 30-40 article titles was created, but cut down randomly for survey length purposes. The intention of this subsection was to have the respondents be compared versus the sample, and flag the users who were deemed more susceptible to finding topics more exciting than others, or potentially more informative or interesting than versus others. The rating was based on a one to five scale, with one being lack of agreement and five being fully in agreement. The article titles are depicted in Table 5.

Article Title Rated
"US, Europe prepare sanctions after Crimea votes to join Russia"
"Rapper severs penis, jumps off building"
"Restaurant says it saw ghost on camera"
"Malaysia plane crash: what do we know?"
"Jet dropped nearly 600 feet in 1 minute"
"Will New York City legalize THIS?"
"Meet the terrorists who scare al-Qaeda"
"Diplomatic talks in Ukraine last until dawn"
"Police: girl stabbed 19 times by friends"
"Gunman kills 3 officers, still at large"
"US soccer's horrible mistake"
"White supremacist ID'd as gunman in deadly shootings at Jewish centers"

Table 5: Article titles rated based upon excitement, interest, and information

The second subsection was mostly a bonus section, where the respondent was asked to rate 10 different movies based upon how well they believed they accurately depicted science. If the respondent was unsure or had not seen the movie, they were prompted not to respond. Unfortunately, this is likely why sample sizes within this section were very small, and thus this section was largely disregarded. The rating system was again one through five, with one representing scientifically inaccurate and five representing scientifically accurate. The 10 different movie titles are listed in Table 6 below.

Movie Rated
The Day After Tomorrow
Star Wars
2012
Lucy
Armageddon
Deep Impact
Jurassic Park
Contact
Minority Report
Volcano

Table 6: Rating titles based upon how scientifically accurate respondent perceives the movie

Distribution of Survey

The survey was distributed in large part among staff and faculty throughout the University of Central Florida. Thus, the conclusion of any results is very likely limited to faculty, staff, and students at the university level. This was kept in mind and will be discussed in further detail in the results when taking into consideration the demographics. The survey was considered exempted research by the Institutional Review Board. While no restrictions were tightly placed on how the survey was distributed, careful measures were made in tracking the audience reached.

Usage of Statistical Analyses

Sampling.

All sampling was considered snowball sampling. The population was considered to be students, faculty, and staff at the university level in the United States. Though the grouping of individuals based upon their number of pseudoscientific beliefs has been referred to as strata, it must be noted that this survey was not conducted as stratified sampling – the stratification came after the fact.

Student's t-test.

The primary tool used in analysis was the Student's t-test. The assumption that the population was normally distributed was made. Stratified sample sizes varied from 36 to 100, thus the t-test was deemed appropriate. Individual questions or rated statements were not able to be taken into account, as the sample sizes were driven to statistically insignificant levels. Instead, the stratification of respondents was based upon pooling of all questions and rated statements within the third section of the survey.

Two-sampled t-tests were used based upon the samples of the stratified groups. A control group was established, filled with respondents who did not have any pseudoscientific beliefs. The stratification of pseudoscientific beliefs were broken up into the following groups: just one pseudoscientific belief, one or more pseudoscientific beliefs, more than one pseudoscientific beliefs, and three or more pseudoscientific beliefs. It is important to note that these groups may overlap, and so certain groups could not be compared to one another without violating a requirement of independence.

Once the groups (or strata) were established, a mean and a standard deviation were calculated for every response in the fourth section of the survey, based upon group. Equation 1 and Equation 2 listed below represent the sample mean, $\overline{x}$, and the standard deviation of the sample, s. The sample size is represented by N.

$$\bar{x} = \sum_{i=1}^{N} x_i \quad (1)$$

$$s^2 = \frac{1}{N-1}\sum_{i=1}^{N}(x_i - \overline{x})^2 \qquad (2)$$

Following these calculations, a t-statistic was obtained from a t-table, based upon a 90% confidence level[19]. Each t-statistic took used the degrees of freedom, calculated as $v = N - 1$. The equation for the confidence interval is listed below in Equation 3.

$$Confidence\ Interval = \bar{x} \pm t_{v,\alpha}\frac{s}{\sqrt{N}} \qquad (3)$$

In this case, α represents the compliment to the confidence level. The tests conducted were assumed to be centered around the mean, and so two-tailed t-values were obtained at α/2.

Hypothesis testing via critical value approach.

Two-sampled t-tests were conducted to compare each stratified group with the control group. Due to smaller sample sizes, a confidence level of 90% was chosen as a basis. The null hypothesis, H_0, was that there was no statistical difference between the means. The alternative hypothesis, H_a, was that the means were statistically not the same. The pooled standard deviation was calculated in each case, as was the critical t-score. These two equations are listed as Equation 4 and Equation 5 below, respectively[20].

$$s_p^2 = \frac{(N_1-1)s_1^2-(N_2-1)s_2^2}{N_1+N_2-2} \qquad (4)$$

$$t^* = \frac{\overline{x_1}-\overline{x_2}+\Delta}{s_p\sqrt{\frac{1}{N_1}+\frac{1}{N_2}}} \qquad (5)$$

In these cases, s_p is the pooled standard deviation, t^* is the calculated t-score, and Δ is the hypothesized difference between the two population means. For testing the null hypothesis that the means are equal, $\Delta = 0$. The critical value was then taken and compared to the t-score at the pooled sample size at 90% confidence. If the calculated t-score was larger than the magnitude of the critical t-score of the pooled sample size, then it could be said at 90% confidence that the means were different.

RESULTS & DISCUSSION

Overview

Through utilization of the student's t-distribution, in every single case, there was a failure to reject the null hypothesis. That is to say, no discernable difference was shown between how people sensational a respondent saw different news articles in section four of the survey versus how many pseudoscientific answers they had.

This does not necessarily imply that there is no relationship between ability to dictate science from pseudoscience and general susceptibility to sensationalized media. Rather, the results appear inconclusive, likely as a result of the way in which the fourth section of the survey was designed. Other possible sources for the null results could have been due to the possibility that there was indeed no difference in the population means. Additionally, sample sizes could also bring down the significance of the results.

Though the initial target of the research came up as null, several other conclusions were still able to be reached based upon the extensive size of the survey. They are presented in the following sections of this chapter.

Audience Reached

The survey was completed by 148 respondents. The audience reached in this case was predominantly aged 18-25, indicating mostly the undergraduate and graduate students in which the survey was distributed amongst. The results are bimodal in age, indicating both students and professors or staff participated in the survey. Figure 1 depicts the distribution of ages, showing the first mode at age 21 and the second mode at age 30. The mean of the first mode was at age 21, whereas the mean of the second mode was at age 35.

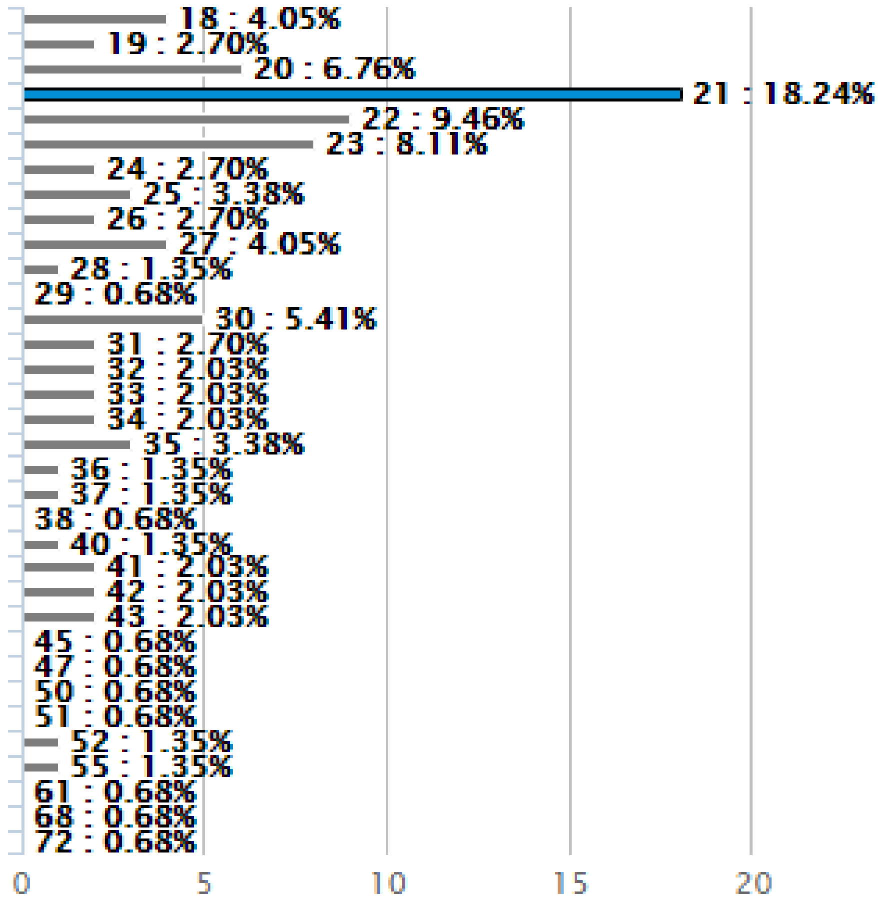


Figure 1: Age distributions with percentage on the x-axis and age on the y-axis going down

When it came to gender, the results were split evenly as expected; 49.31% were female and 50.69% were male. When it came to highest level of attained education, undergraduate students and individuals with bachelor's degrees made up roughly 60% of the sample. Figure 2 depicts the distribution based upon increasing education level.

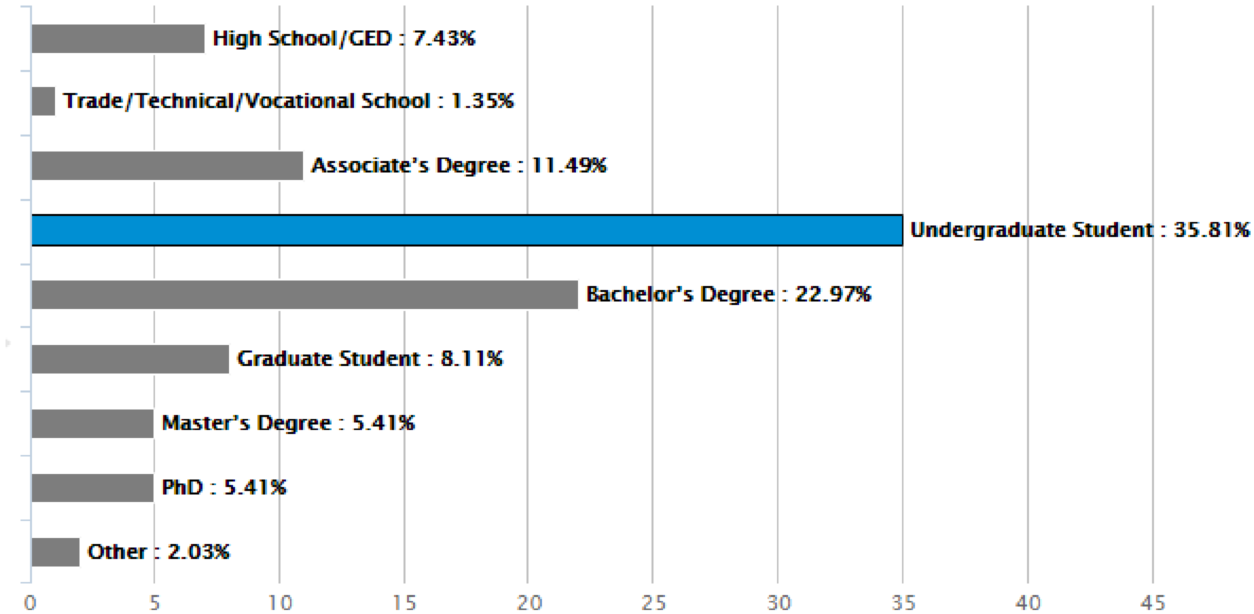


Figure 2: Distribution of levels of education with percentages on the x-axis and increasing level of education on the y-axis going down

The areas of study tended to match distributions of a typical research institution, with a slight bias towards engineering and computer science. Figure 3 shows a pie chart of all of the percentages of areas of study.

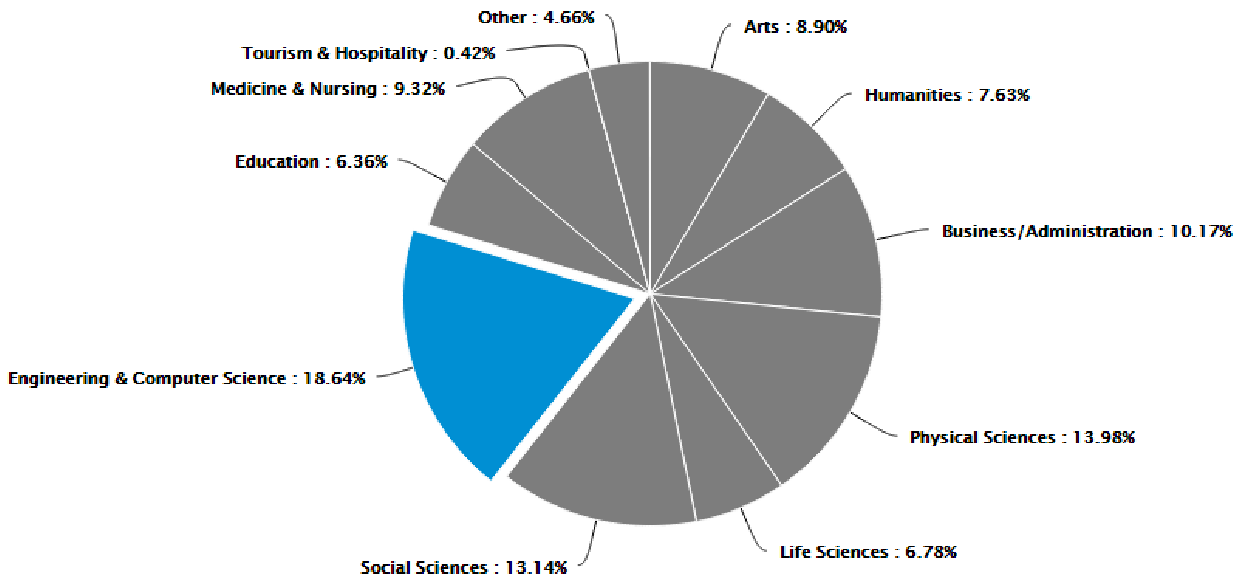


Figure 3: Pie chart showing breakdown of areas of study from respondents

It is important to note here that in Figure 3, the respondents were able to choose up to two different areas of study.

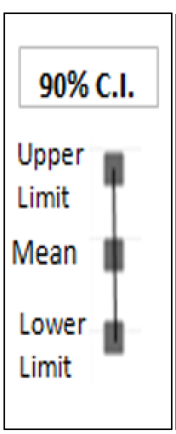
Remarks about the population through the sample.

The results of these main demographics as well as the careful tracking of distribution of the survey are why all conclusions based out of this study must be made in regards to individuals at the university level, be they students, faculty, or staff. Again, that is to say that the results of this research do not make conclusions based upon the average individual, but rather the average student, faculty, or staff member at the university level.

Results

Science versus sensationalism.

This section of the results aimed at providing a statistical establishment showing that more pseudoscientific beliefs would lead to different levels of excitement and interest in generally less informative article titles that the respondents had to rate in the fourth section of the survey. The results showed to be inconclusive. For all twelve article titles, through three different ratings for excitement, interest, and information, the two-sampled t-test failed to discern any differences between the varying levels of pseudoscientific answers. These tests were conducted at 90% confidence. Additionally, 90% confidence intervals were created for each rating on each article title. Figure 5 through Figure 16 serve as visual guides depicting these confidence intervals, as a simple way to condense large amounts of data. Figure 4 is a key for Figure 5 through Figure 16. Table 7 through Table 18 depict the very same data down to the exact numbers.



Group Number	Qualitative Representation	Boolean Representation of x amount of pseudoscientific answers
1	All respondents with no pseudoscientific answers	x = 0
2	All respondents with just one pseudoscientific answer	x = 1
3	All respondents with one or more pseudoscientific answers	x ≥ 1
4	All respondents with more than one pseudoscientific answer	x > 1
5	All respondents with three or more pseudoscientific answers	x ≥ 3

Figure 4: Key for Figure 5 through Figure 16 representations (left) and group number representations (right)

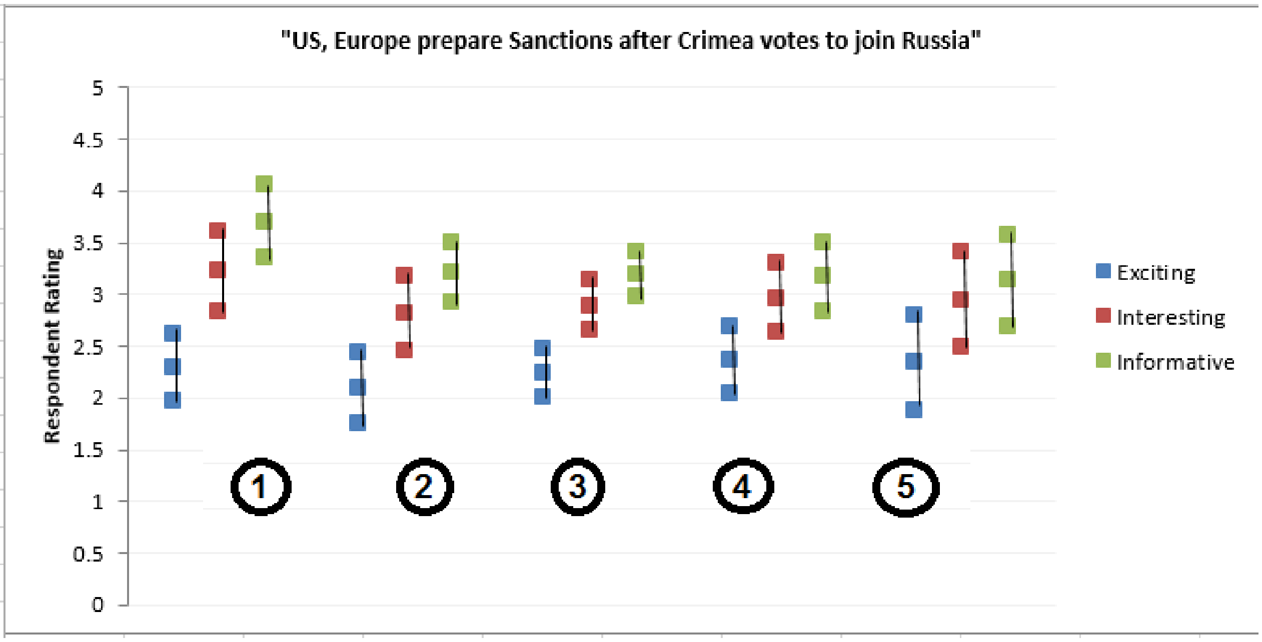


Figure 5: Visual representation of individual 90% confidence intervals for each group 1 to 5 for article title 1

	Group	Mean	Standard Deviation	N-1	t-score	Lower Confidence Interval	Upper Confidence Interval
Exciting	1	2.283	1.109	45	2.014	1.953	2.612
Interesting	1	3.217	1.315	45	2.014	2.827	3.608
Informative	1	3.696	1.190	45	2.014	3.342	4.049
Exciting	2	2.087	1.132	45	2.014	1.751	2.423
Interesting	2	2.813	1.232	47	2.012	2.455	3.170
Informative	2	3.200	0.968	44	2.015	2.909	3.491
Exciting	3	2.227	1.150	96	1.985	1.995	2.459
Interesting	3	2.888	1.200	97	1.985	2.647	3.128
Informative	3	3.179	1.062	94	1.986	2.963	3.395
Exciting	4	2.353	1.163	50	2.009	2.026	2.680
Interesting	4	2.960	1.177	49	2.010	2.625	3.295
Informative	4	3.160	1.149	49	2.010	2.833	3.487
Exciting	5	2.333	1.291	32	2.037	1.876	2.791
Interesting	5	2.938	1.268	31	2.040	2.480	3.395
Informative	5	3.125	1.238	31	2.040	2.679	3.571

Table 7: Table of data belonging to Figure 5, article title 1

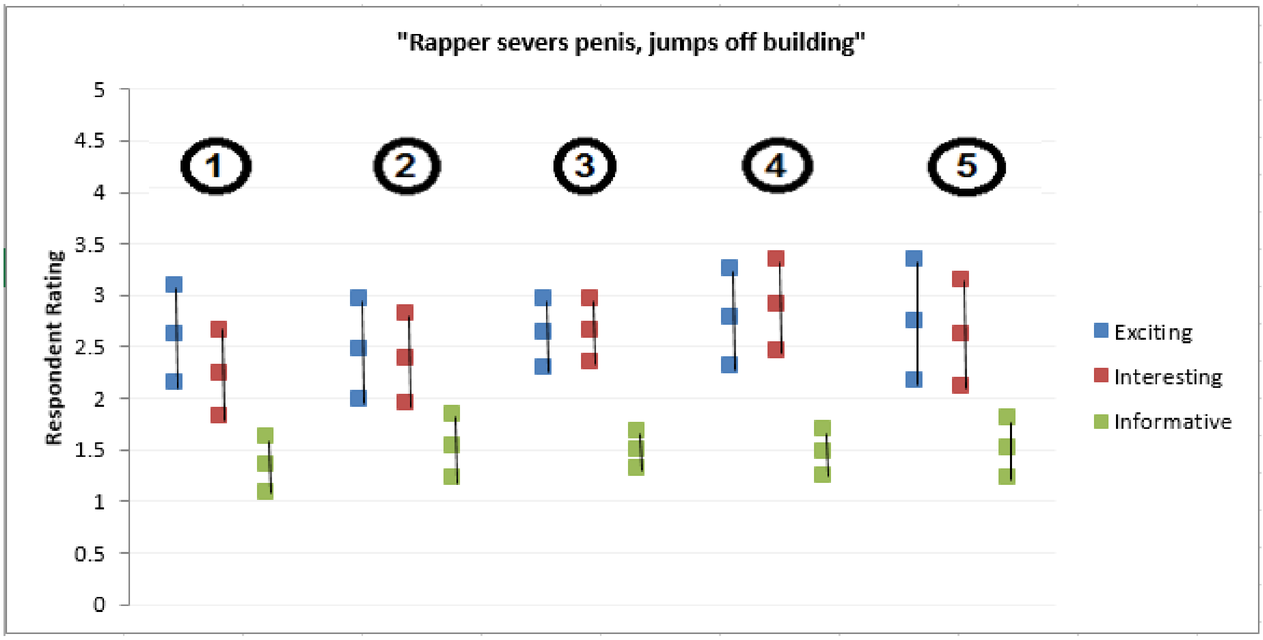


Figure 6: Visual representation of individual 90% confidence intervals for each group 1 to 5 for article title 2

	Group	Mean	Standard Deviation	N-1	t-score	Lower Confidence Interval	Upper Confidence Interval
Exciting	1	2.609	1.584	45	2.014	2.138	3.079
Interesting	1	2.239	1.401	45	2.014	1.823	2.655
Informative	1	1.348	0.900	45	2.014	1.081	1.615
Exciting	2	2.467	1.632	44	2.015	1.976	2.957
Interesting	2	2.383	1.483	46	2.013	1.948	2.818
Informative	2	1.533	1.014	44	2.015	1.229	1.838
Exciting	3	2.632	1.638	94	1.986	2.298	2.965
Interesting	3	2.649	1.541	96	1.985	2.339	2.960
Informative	3	1.500	0.894	95	1.985	1.319	1.681
Exciting	4	2.780	1.645	49	2.010	2.313	3.247
Interesting	4	2.900	1.568	49	2.010	2.454	3.346
Informative	4	1.471	0.784	50	2.009	1.250	1.691
Exciting	5	2.750	1.626	31	2.040	2.164	3.336
Interesting	5	2.625	1.431	31	2.040	2.109	3.141
Informative	5	1.515	0.795	32	2.037	1.233	1.797

Table 8: Table of data belonging to Figure 6, article title 2

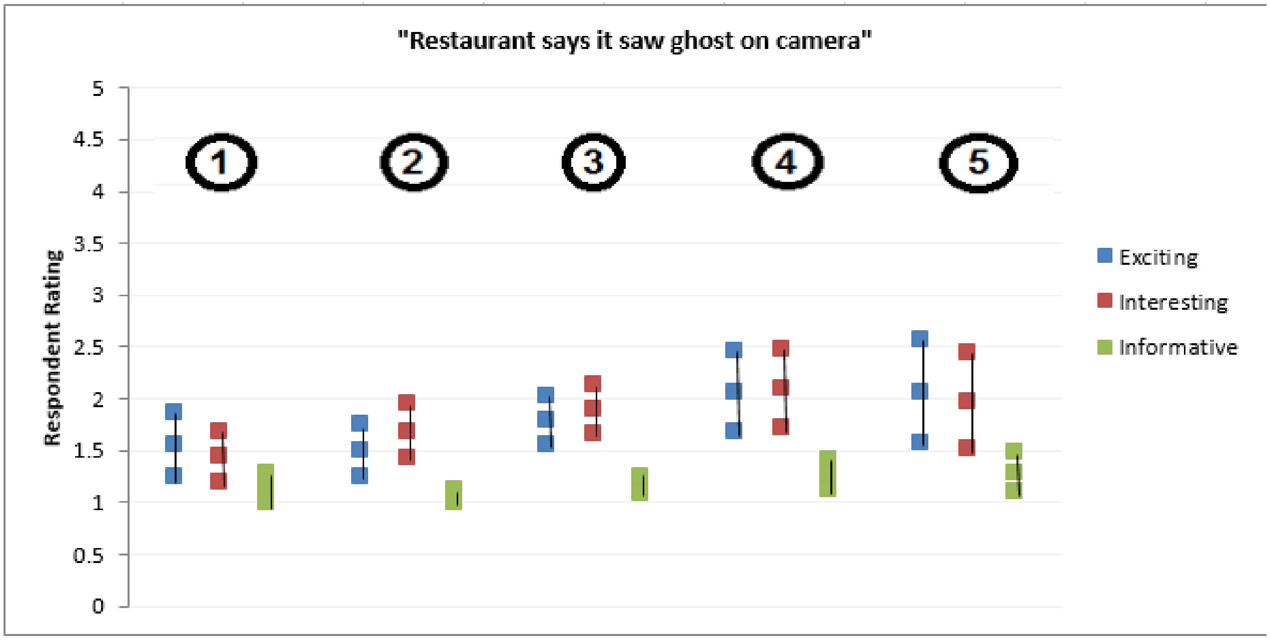


Figure 7: Visual representation of individual 90% confidence intervals for each group 1 to 5 for article title 3

	Group	Mean	Standard Deviation	N-1	t-score	Lower Confidence Interval	Upper Confidence Interval
Exciting	1	1.543	1.026	45	2.014	1.239	1.848
Interesting	1	1.435	0.834	45	2.014	1.187	1.682
Informative	1	1.130	0.499	45	2.014	0.982	1.279
Exciting	2	1.489	0.843	44	2.015	1.236	1.742
Interesting	2	1.681	0.887	46	2.013	1.420	1.941
Informative	2	1.044	0.208	44	2.015	0.982	1.107
Exciting	3	1.789	1.175	94	1.986	1.550	2.029
Interesting	3	1.898	1.171	97	1.985	1.663	2.133
Informative	3	1.158	0.421	94	1.986	1.072	1.244
Exciting	4	2.060	1.361	49	2.010	1.673	2.447
Interesting	4	2.098	1.360	50	2.009	1.715	2.481
Informative	4	1.260	0.527	49	2.010	1.110	1.410
Exciting	5	2.063	1.390	31	2.040	1.561	2.564
Interesting	5	1.970	1.311	32	2.037	1.505	2.434
Informative	5	1.281	0.523	31	2.040	1.093	1.470

Table 9: Table of data belonging to Figure 7, article title 3

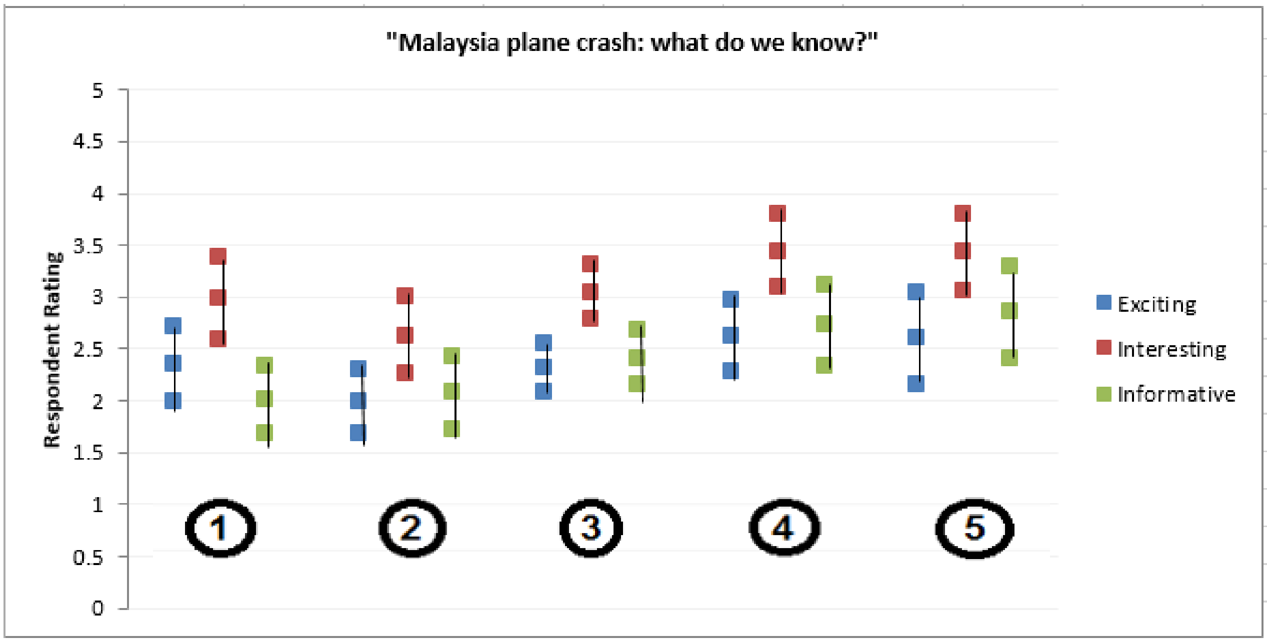


Figure 8: Visual representation of individual 90% confidence intervals for each group 1 to 5 for article title 4

	Group	Mean	Standard Deviation	N-1	t-score	Lower Confidence Interval	Upper Confidence Interval
Exciting	1	2.348	1.233	45	2.014	1.982	2.714
Interesting	1	2.978	1.325	45	2.014	2.585	3.372
Informative	1	2.000	1.095	45	2.014	1.675	2.325
Exciting	2	1.978	1.043	45	2.014	1.668	2.288
Interesting	2	2.625	1.299	47	2.012	2.248	3.002
Informative	2	2.065	1.181	45	2.014	1.714	2.416
Exciting	3	2.313	1.173	95	1.985	2.075	2.550
Interesting	3	3.040	1.332	98	1.985	2.775	3.306
Informative	3	2.406	1.311	95	1.985	2.141	2.672
Exciting	4	2.620	1.210	49	2.010	2.276	2.964
Interesting	4	3.431	1.253	50	2.009	3.079	3.784
Informative	4	2.720	1.356	49	2.010	2.335	3.105
Exciting	5	2.594	1.241	31	2.040	2.146	3.041
Interesting	5	3.424	1.062	32	2.037	3.048	3.801
Informative	5	2.844	1.221	31	2.040	2.404	3.284

Table 10: Table of data belonging to Figure 8, article title 4

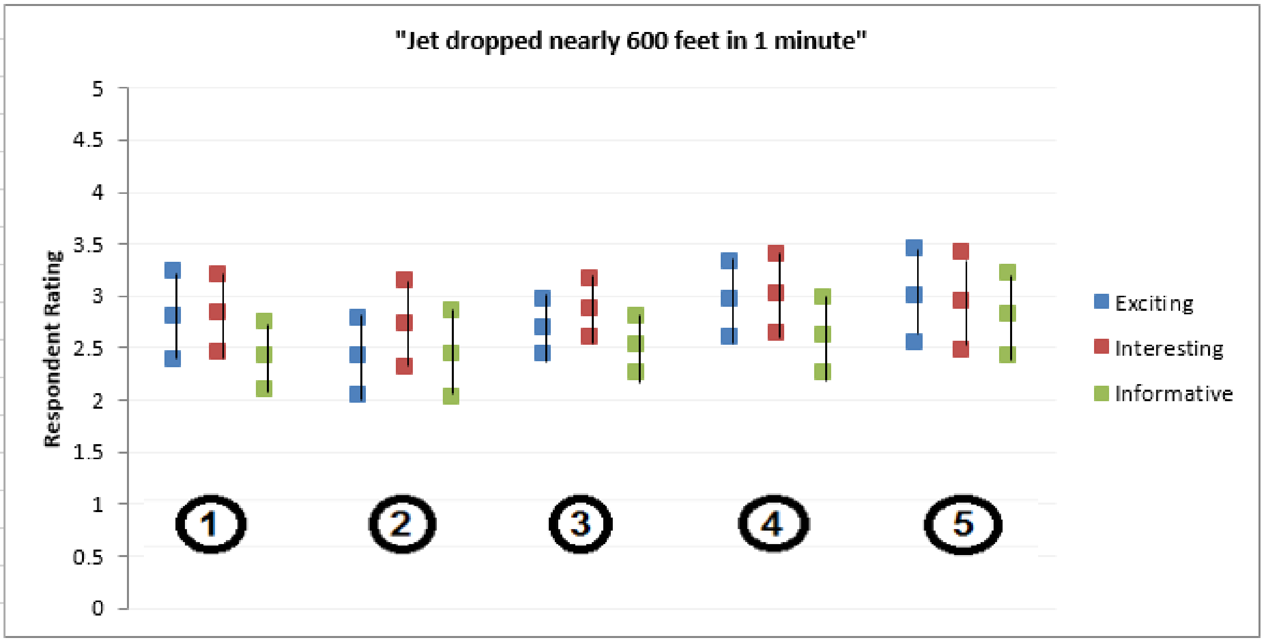


Figure 9: Visual representation of individual 90% confidence intervals for each group 1 to 5 for article title 5

	Group	Mean	Standard Deviation	N-1	t-score	Lower Confidence Interval	Upper Confidence Interval
Exciting	1	2.804	1.439	45	2.014	2.377	3.232
Interesting	1	2.826	1.270	45	2.014	2.449	3.203
Informative	1	2.413	1.107	45	2.014	2.084	2.742
Exciting	2	2.413	1.257	45	2.014	2.040	2.786
Interesting	2	2.729	1.440	47	2.012	2.311	3.147
Informative	2	2.435	1.393	45	2.014	2.021	2.848
Exciting	3	2.698	1.299	95	1.985	2.435	2.961
Interesting	3	2.879	1.402	98	1.985	2.599	3.158
Informative	3	2.531	1.322	95	1.985	2.263	2.799
Exciting	4	2.960	1.293	49	2.010	2.593	3.327
Interesting	4	3.020	1.364	50	2.009	2.636	3.403
Informative	4	2.620	1.260	49	2.010	2.262	2.978
Exciting	5	3.000	1.244	31	2.040	2.551	3.449
Interesting	5	2.939	1.321	32	2.037	2.471	3.408
Informative	5	2.813	1.120	31	2.040	2.409	3.216

Table 11: Table of data belonging to Figure 9, article title 5

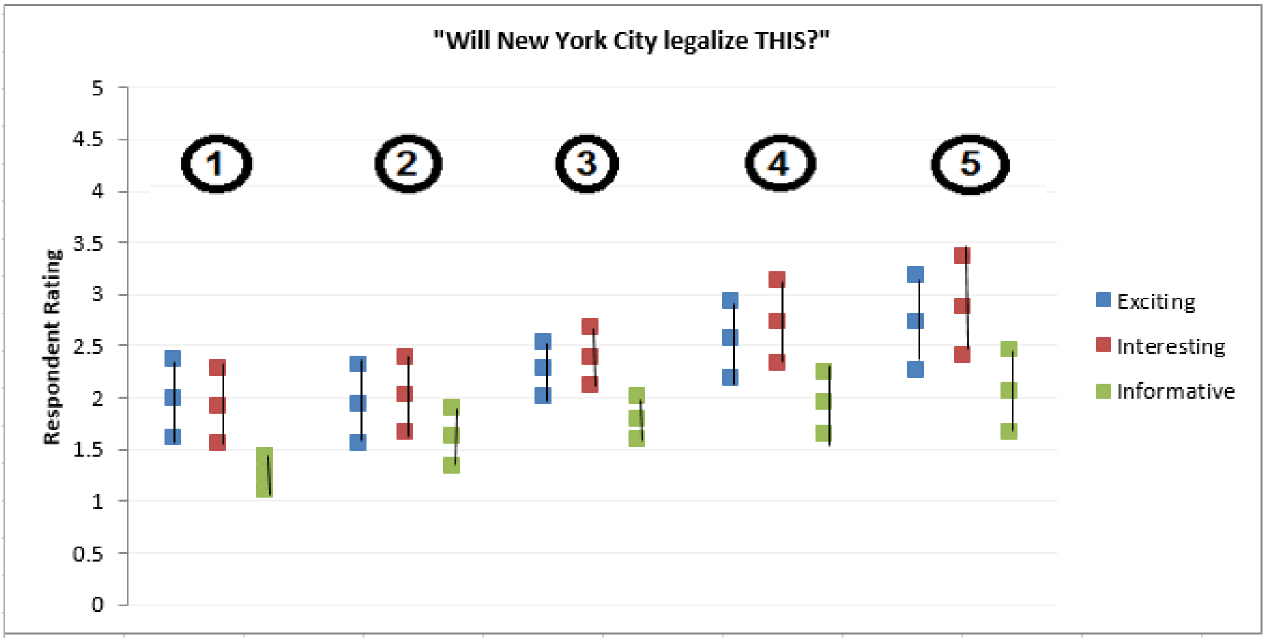


Figure 10: Visual representation of individual 90% confidence intervals for each group 1 to 5 for article title 6

	Group	Mean	Standard Deviation	N-1	t-score	Lower Confidence Interval	Upper Confidence Interval
Exciting	1	1.978	1.273	45	2.014	1.600	2.356
Interesting	1	1.913	1.226	45	2.014	1.549	2.277
Informative	1	1.261	0.575	45	2.014	1.090	1.432
Exciting	2	1.932	1.246	43	2.017	1.553	2.311
Interesting	2	2.021	1.242	46	2.013	1.657	2.386
Informative	2	1.614	0.945	43	2.017	1.326	1.901
Exciting	3	2.266	1.305	93	1.986	1.999	2.533
Interesting	3	2.388	1.382	97	1.985	2.111	2.665
Informative	3	1.787	1.015	93	1.986	1.579	1.995
Exciting	4	2.560	1.296	49	2.010	2.192	2.928
Interesting	4	2.725	1.429	50	2.009	2.323	3.128
Informative	4	1.940	1.058	49	2.010	1.639	2.241
Exciting	5	2.719	1.276	31	2.040	2.259	3.179
Interesting	5	2.879	1.364	32	2.037	2.395	3.362
Informative	5	2.063	1.105	31	2.040	1.664	2.461

Table 12: Table of data belonging to Figure 10, article title 6

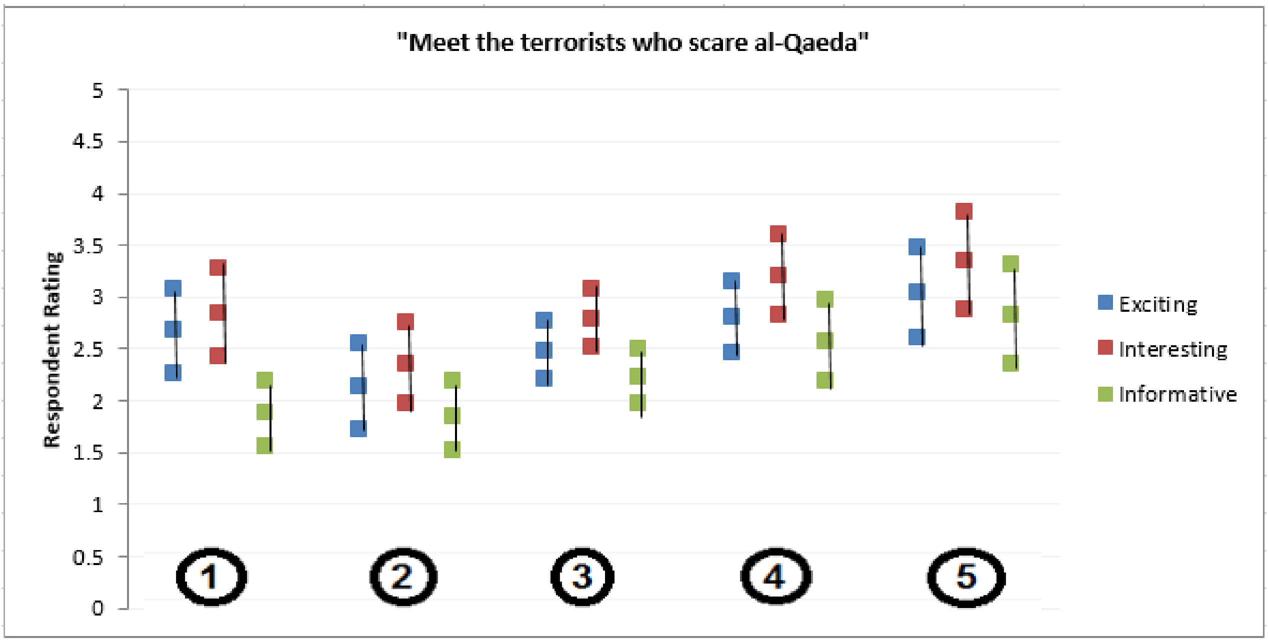


Figure 11: Visual representation of individual 90% confidence intervals for each group 1 to 5 for article title 7

	Group	Mean	Standard Deviation	N-1	t-score	Lower Confidence Interval	Upper Confidence Interval
Exciting	1	2.667	1.348	44	2.015	2.262	3.072
Interesting	1	2.841	1.380	43	2.017	2.421	3.260
Informative	1	1.867	1.036	44	2.015	1.555	2.178
Exciting	2	2.130	1.424	45	2.014	1.708	2.553
Interesting	2	2.354	1.329	47	2.012	1.968	2.740
Informative	2	1.848	1.135	45	2.014	1.511	2.185
Exciting	3	2.479	1.353	95	1.985	2.205	2.753
Interesting	3	2.786	1.401	97	1.985	2.505	3.067
Informative	3	2.227	1.327	96	1.985	1.959	2.494
Exciting	4	2.800	1.212	49	2.010	2.455	3.145
Interesting	4	3.200	1.355	49	2.010	2.815	3.585
Informative	4	2.569	1.404	50	2.009	2.174	2.963
Exciting	5	3.031	1.204	31	2.040	2.597	3.465
Interesting	5	3.344	1.310	31	2.040	2.871	3.816
Informative	5	2.818	1.357	32	2.037	2.337	3.299

Table 13: Table of data belonging to Figure 11, article title 7

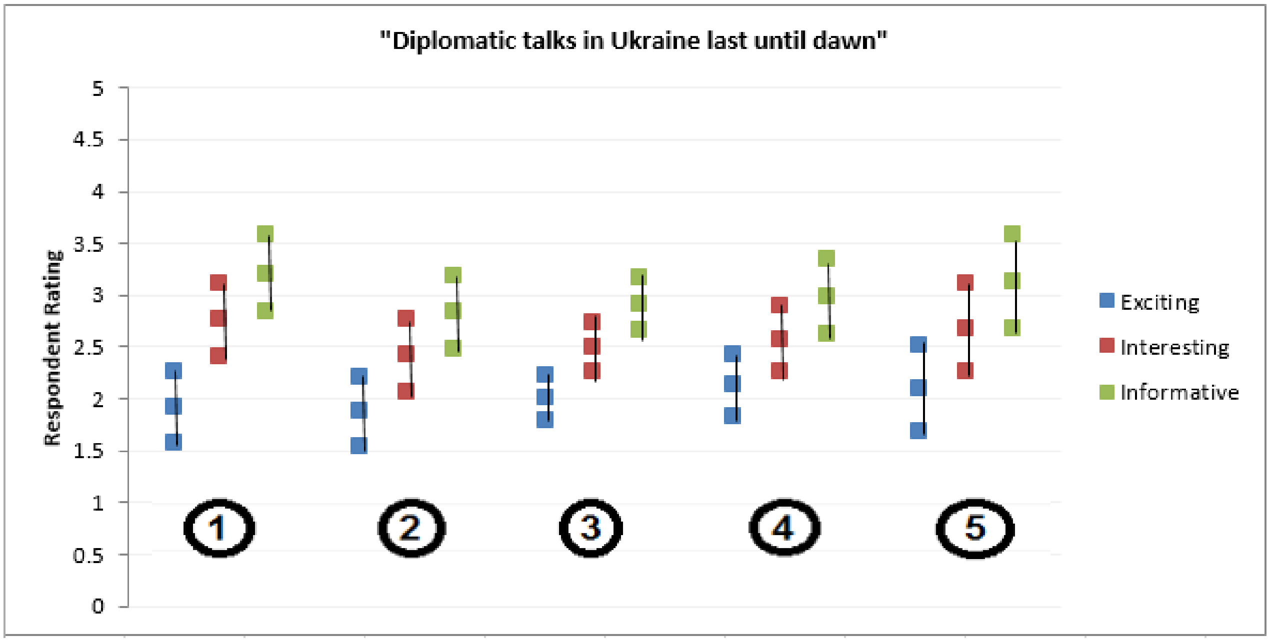


Figure 12: Visual representation of individual 90% confidence intervals for each group 1 to 5 for article title 8

	Group	Mean	Standard Deviation	N-1	t-score	Lower Confidence Interval	Upper Confidence Interval
Exciting	1	1.911	1.164	44	2.015	1.561	2.261
Interesting	1	2.756	1.190	44	2.015	2.398	3.113
Informative	1	3.200	1.236	44	2.015	2.829	3.571
Exciting	2	1.870	1.128	45	2.014	1.535	2.204
Interesting	2	2.417	1.217	47	2.012	2.063	2.770
Informative	2	2.826	1.198	45	2.014	2.470	3.182
Exciting	3	2.000	1.082	94	1.986	1.780	2.220
Interesting	3	2.495	1.156	96	1.985	2.262	2.728
Informative	3	2.906	1.232	95	1.985	2.657	3.156
Exciting	4	2.122	1.033	48	2.011	1.826	2.419
Interesting	4	2.571	1.099	48	2.011	2.256	2.887
Informative	4	2.980	1.270	49	2.010	2.619	3.341
Exciting	5	2.097	1.136	30	2.042	1.680	2.513
Interesting	5	2.677	1.166	30	2.042	2.250	3.105
Informative	5	3.125	1.264	31	2.040	2.669	3.581

Table 14: Table of data belonging to Figure 12, article title 8

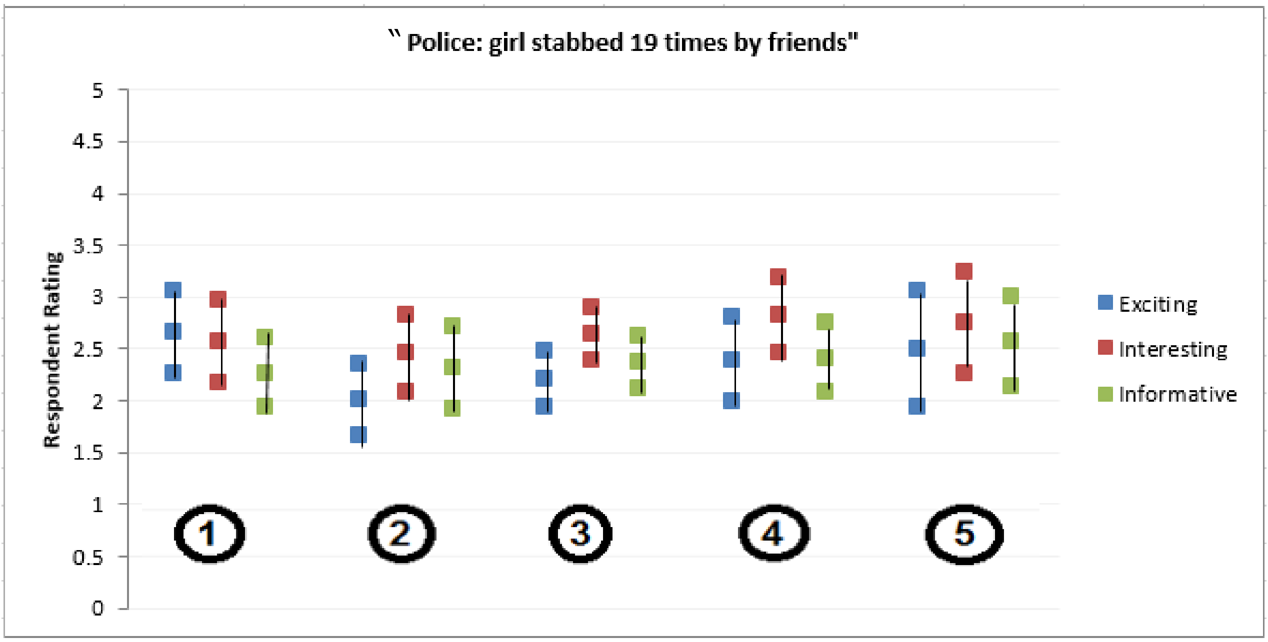


Figure 13: Visual representation of individual 90% confidence intervals for each group 1 to 5 for article title 9

	Group	Mean	Standard Deviation	N-1	t-score	Lower Confidence Interval	Upper Confidence Interval
Exciting	1	2.652	1.353	45	2.014	2.250	3.054
Interesting	1	2.565	1.344	45	2.014	2.166	2.964
Informative	1	2.261	1.144	45	2.014	1.921	2.601
Exciting	2	2.000	1.128	44	2.015	1.661	2.339
Interesting	2	2.447	1.265	46	2.013	2.075	2.818
Informative	2	2.311	1.345	44	2.015	1.907	2.715
Exciting	3	2.202	1.292	93	1.986	1.938	2.467
Interesting	3	2.635	1.258	95	1.985	2.381	2.890
Informative	3	2.358	1.254	94	1.986	2.102	2.613
Exciting	4	2.388	1.412	48	2.011	1.982	2.793
Interesting	4	2.816	1.236	48	2.011	2.461	3.171
Informative	4	2.400	1.178	49	2.010	2.065	2.735
Exciting	5	2.484	1.525	30	2.042	1.925	3.043
Interesting	5	2.742	1.316	30	2.042	2.259	3.225
Informative	5	2.563	1.216	31	2.040	2.124	3.001

Table 15: Table of data belonging to Figure 13, article title 9

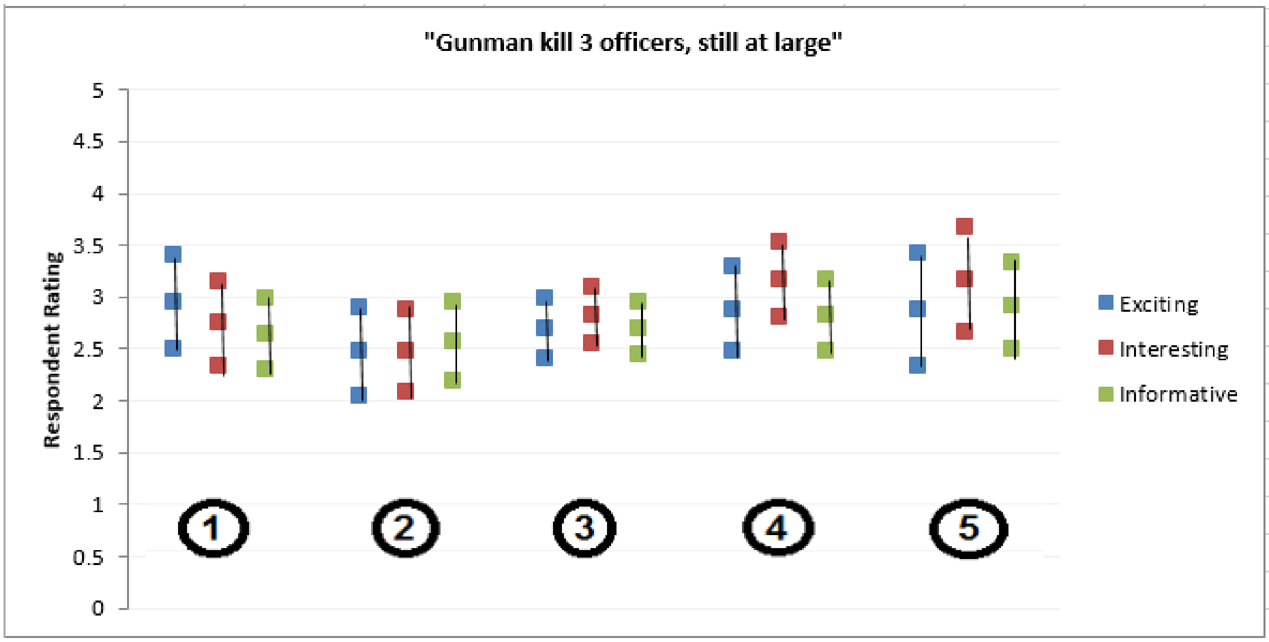


Figure 14: Visual representation of individual 90% confidence intervals for each group 1 to 5 for article title 10

	Group	Mean	Standard Deviation	N-1	t-score	Lower Confidence Interval	Upper Confidence Interval
Exciting	1	2.935	1.526	45	2.014	2.482	3.388
Interesting	1	2.739	1.357	45	2.014	2.336	3.142
Informative	1	2.630	1.142	45	2.014	2.291	2.970
Exciting	2	2.467	1.408	44	2.015	2.044	2.890
Interesting	2	2.468	1.365	46	2.013	2.067	2.869
Informative	2	2.565	1.294	45	2.014	2.181	2.949
Exciting	3	2.681	1.416	93	1.986	2.391	2.971
Interesting	3	2.823	1.346	95	1.985	2.550	3.096
Informative	3	2.698	1.249	95	1.985	2.445	2.951
Exciting	4	2.878	1.409	48	2.011	2.473	3.282
Interesting	4	3.163	1.247	48	2.011	2.805	3.522
Informative	4	2.820	1.207	49	2.010	2.477	3.163
Exciting	5	2.871	1.477	30	2.042	2.329	3.413
Interesting	5	3.161	1.369	30	2.042	2.659	3.663
Informative	5	2.906	1.174	31	2.040	2.483	3.329

Table 16: Table of data belonging to Figure 14, article title 10

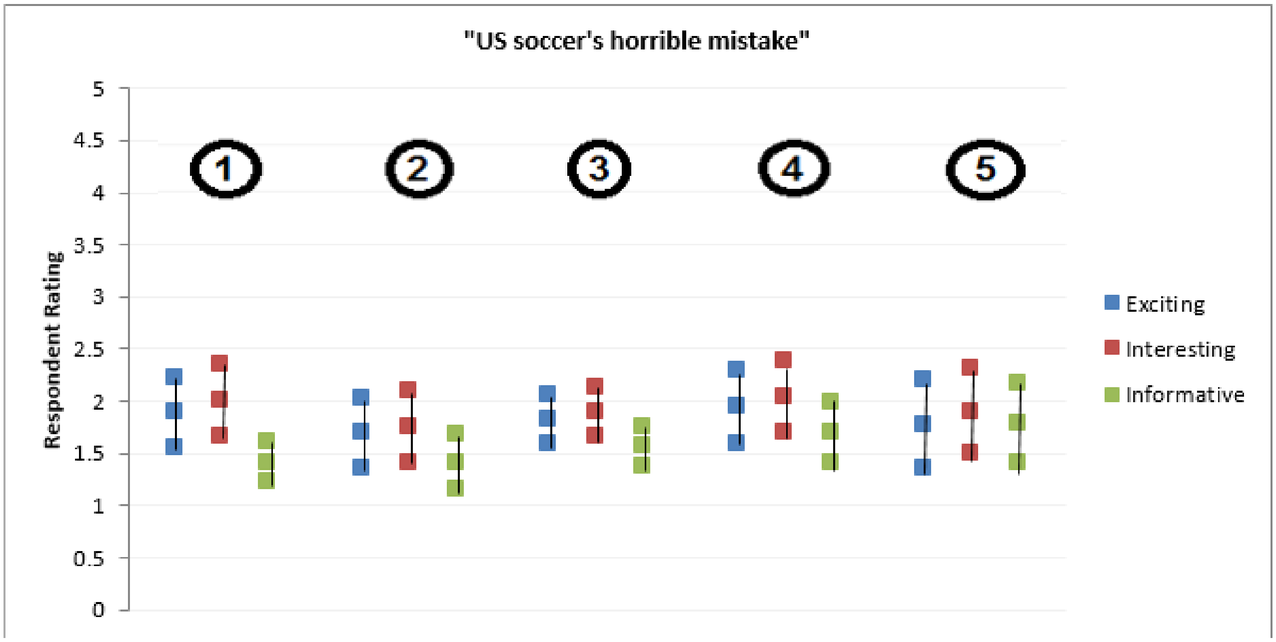


Figure 15: Visual representation of individual 90% confidence intervals for each group 1 to 5 for article title 11

	Group	Mean	Standard Deviation	N-1	t-score	Lower Confidence Interval	Upper Confidence Interval
Exciting	1	1.891	1.120	45	2.014	1.559	2.224
Interesting	1	2.000	1.135	45	2.014	1.663	2.337
Informative	1	1.413	0.617	45	2.014	1.230	1.596
Exciting	2	1.689	1.104	44	2.015	1.357	2.021
Interesting	2	1.745	1.170	46	2.013	1.401	2.088
Informative	2	1.409	0.871	43	2.017	1.144	1.674
Exciting	3	1.819	1.154	93	1.986	1.583	2.056
Interesting	3	1.895	1.171	94	1.986	1.656	2.133
Informative	3	1.559	0.949	92	1.986	1.364	1.755
Exciting	4	1.939	1.197	48	2.011	1.595	2.283
Interesting	4	2.042	1.166	47	2.012	1.703	2.380
Informative	4	1.694	1.004	48	2.011	1.405	1.982
Exciting	5	1.774	1.146	30	2.042	1.354	2.195
Interesting	5	1.900	1.094	29	2.045	1.492	2.308
Informative	5	1.781	1.039	31	2.040	1.407	2.156

Table 17: Table of data belonging to Figure 15, article title 11

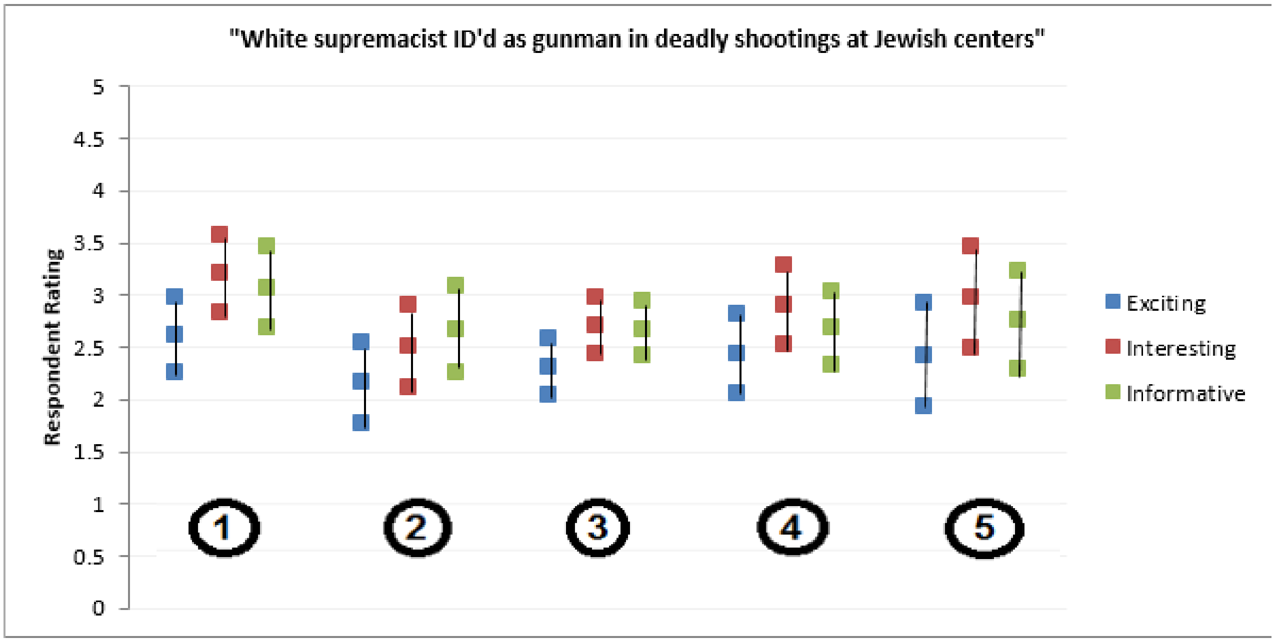


Figure 16: Visual representation of individual 90% confidence intervals for each group 1 to 5 for article title 12

	Group	Mean	Standard Deviation	N-1	t-score	Lower Confidence Interval	Upper Confidence Interval
Exciting	1	2.609	1.201	45	2.014	2.252	2.965
Interesting	1	3.196	1.258	45	2.014	2.822	3.569
Informative	1	3.067	1.286	44	2.015	2.680	3.453
Exciting	2	2.156	1.296	44	2.015	1.766	2.545
Interesting	2	2.500	1.353	47	2.012	2.107	2.893
Informative	2	2.660	1.403	46	2.013	2.248	3.072
Exciting	3	2.298	1.302	93	1.986	2.031	2.565
Interesting	3	2.701	1.340	96	1.985	2.431	2.971
Informative	3	2.670	1.313	96	1.985	2.406	2.935
Exciting	4	2.429	1.307	48	2.011	2.053	2.804
Interesting	4	2.898	1.311	48	2.011	2.521	3.274
Informative	4	2.680	1.236	49	2.010	2.329	3.031
Exciting	5	2.419	1.336	30	2.042	1.929	2.909
Interesting	5	2.968	1.329	30	2.042	2.480	3.455
Informative	5	2.750	1.295	31	2.040	2.283	3.217

Table 18: Table of data belonging to Figure 16, article title 12

Careful investigation of these numbers points towards inconclusive results. Observing the trends in each category from Figure 5 to Figure 16 shows a general lack of difference. To be statistically certain of this, the two-sampled t-test was used, and hypothesis testing confirmed a failure to reject the null hypothesis in each and every case of group 2-5 against group 1. Table 19 through Table 22 show the results of the hypothesis testing through the critical value approach, where all cases failed to reject the null hypothesis.

Group 1 vs. Group 2	Exciting	Interesting	Informative	Exciting	Interestin3	Informative
Article Title	1	1	1	3	3	3
Pooled Variance	1.255	1.621	1.179	0.884	0.742	0.148
Pooled Sample Size	92	94	91	91	93	91
Pooled Degrees of Freedom	90	92	89	89	91	89
Critical t-Value (a = 10%)	2.280	2.279	2.280	2.280	2.279	2.280
Calculated t-Value	0.122	0.222	0.319	0.041	0.200	0.157
Accept Alternative Hypothesis?	NO	NO	NO	NO	NO	NO
Article Title	2	2	2	4	4	4
Pooled Variance	2.586	2.082	0.917	1.305	1.720	1.298
Pooled Sample Size	91	93	91	92	94	92
Pooled Degrees of Freedom	89	91	89	90	92	90
Critical t-Value (a = 10%)	2.280	2.279	2.280	2.280	2.279	2.280
Calculated t-Value	0.062	0.070	0.135	0.226	0.188	0.040
Accept Alternative Hypothesis?	NO	NO	NO	NO	NO	NO
Article Title	5	5	5	6	6	6
Pooled Variance	1.827	1.849	1.583	1.588	1.523	0.606
Pooled Sample Size	92	94	92	90	93	90
Pooled Degrees of Freedom	90	92	90	88	91	88
Critical t-Value (a = 10%)	2.280	2.279	2.280	2.280	2.279	2.280
Calculated t-Value	0.202	0.050	0.012	0.026	0.061	0.317
Accept Alternative Hypothesis?	NO	NO	NO	NO	NO	NO
Article Title	7	7	7	8	8	8
Pooled Variance	1.924	1.832	1.181	1.313	1.450	1.481
Pooled Sample Size	91	92	91	91	93	91
Pooled Degrees of Freedom	89	90	89	89	91	89
Critical t-Value (a = 10%)	2.280	2.280	2.280	2.280	2.279	2.280
Calculated t-Value	0.270	0.252	0.012	0.025	0.197	0.215
Accept Alternative Hypothesis?	NO	NO	NO	NO	NO	NO
Article Title	9	9	9	10	10	10
Pooled Variance	1.555	1.702	1.556	2.157	1.852	1.489
Pooled Sample Size	91	93	91	91	93	92
Pooled Degrees of Freedom	89	91	89	89	91	90
Critical t-Value (a = 10%)	2.280	2.279	2.280	2.280	2.279	2.280
Calculated t-Value	0.366	0.063	0.028	0.223	0.139	0.037
Accept Alternative Hypothesis?	NO	NO	NO	NO	NO	NO
Article Title	11	11	11	12	12	12
Pooled Variance	1.237	1.329	0.566	1.560	1.709	1.815
Pooled Sample Size	91	93	90	91	94	92
Pooled Degrees of Freedom	89	91	88	89	92	90
Critical t-Value (a = 10%)	2.280	2.279	2.280	2.280	2.279	2.280
Calculated t-Value	0.127	0.155	0.004	0.254	0.372	0.211
Accept Alternative Hypothesis?	NO	NO	NO	NO	NO	NO

Table 19: Critical value method of hypothesis testing of group 1 vs group 2 for sensationalism section

Group 1 vs. Group 3	Exciting	Interesting	Informative	Exciting	Interesting	Informative
Article Title	1	1	1	2	2	2
Pooled Variance	1.293	1.532	1.221	2.626	2.244	0.803
Pooled Sample Size	143	144	141	141	143	142
Pooled Degrees of Freedom	141	142	139	139	141	140
Critical t-Value (a = 10%)	2.276	2.276	2.276	2.276	2.276	2.276
Calculated t-Value	0.034	0.187	0.328	0.010	0.192	0.119
Accept Alternative Hypothesis?	NO	NO	NO	NO	NO	NO
Article Title	3	3	3	4	4	4
Pooled Variance	1.275	1.157	0.200	1.422	1.768	1.551
Pooled Sample Size	141	144	141	142	145	142
Pooled Degrees of Freedom	139	142	139	140	143	140
Critical t-Value (a = 10%)	2.276	2.276	2.276	2.276	2.276	2.276
Calculated t-Value	0.153	0.302	0.043	0.021	0.033	0.229
Accept Alternative Hypothesis?	NO	NO	NO	NO	NO	NO
Article Title	5	5	5	6	6	6
Pooled Variance	1.811	1.854	1.579	1.676	1.781	0.802
Pooled Sample Size	142	145	142	140	144	140
Pooled Degrees of Freedom	140	143	140	138	142	138
Critical t-Value (a = 10%)	2.276	2.276	2.276	2.276	2.276	2.276
Calculated t-Value	0.055	0.027	0.066	0.156	0.249	0.412
Accept Alternative Hypothesis?	NO	NO	NO	NO	NO	NO
Article Title	7	7	7	8	8	8
Pooled Variance	1.827	1.946	1.544	1.229	1.361	1.521
Pooled Sample Size	141	142	142	140	142	141
Pooled Degrees of Freedom	139	140	140	138	140	139
Critical t-Value (a = 10%)	2.276	2.276	2.276	2.276	2.276	2.276
Calculated t-Value	0.097	0.028	0.203	0.056	0.157	0.167
Accept Alternative Hypothesis?	NO	NO	NO	NO	NO	NO
Article Title	9	9	9	10	10	10
Pooled Variance	1.722	1.654	1.487	2.110	1.820	1.478
Pooled Sample Size	140	142	141	140	142	142
Pooled Degrees of Freedom	138	140	139	138	140	140
Critical t-Value (a = 10%)	2.276	2.276	2.276	2.276	2.276	2.276
Calculated t-Value	0.241	0.038	0.056	0.123	0.044	0.039
Accept Alternative Hypothesis?	NO	NO	NO	NO	NO	NO
Article Title	11	11	11	12	12	12
Pooled Variance	1.307	1.345	0.730	1.613	1.727	1.702
Pooled Sample Size	140	141	139	140	143	142
Pooled Degrees of Freedom	138	139	137	138	141	140
Critical t-Value (a = 10%)	2.276	2.276	2.276	2.276	2.276	2.276
Calculated t-Value	0.044	0.064	0.120	0.172	0.264	0.213
Accept Alternative Hypothesis?	NO	NO	NO	NO	NO	NO

Table 20: Critical value method of hypothesis testing of group 1 vs group 3 for sensationalism section

Group 1 vs. Group 4	Exciting	Interesting	Informative	Exciting	Interesting	Informative
Article Title	1	1	1	2	2	2
Pooled Variance	1.294	1.550	1.367	2.612	2.222	0.707
Pooled Sample Size	97	96	96	96	96	97
Pooled Degrees of Freedom	95	94	94	94	94	95
Critical t-Value (a = 10%)	2.278	2.278	2.278	2.278	2.278	2.278
Calculated t-Value	0.043	0.145	0.321	0.074	0.310	0.102
Accept Alternative Hypothesis?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Article Title	3	3	3	4	4	4
Pooled Variance	1.471	1.303	0.264	1.492	1.658	1.533
Pooled Sample Size	96	97	96	96	97	96
Pooled Degrees of Freedom	94	95	94	94	95	94
Critical t-Value (a = 10%)	2.278	2.278	2.278	2.278	2.278	2.278
Calculated t-Value	0.298	0.407	0.176	0.156	0.246	0.407
Accept Alternative Hypothesis?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Article Title	5	5	5	6	6	6
Pooled Variance	1.863	1.743	1.414	1.652	1.787	0.741
Pooled Sample Size	96	97	96	96	97	96
Pooled Degrees of Freedom	94	95	94	94	95	94
Critical t-Value (a = 10%)	2.278	2.278	2.278	2.278	2.278	2.278
Calculated t-Value	0.080	0.103	0.122	0.317	0.425	0.552
Accept Alternative Hypothesis?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Article Title	7	7	7	8	8	8
Pooled Variance	1.634	1.868	1.550	1.206	1.308	1.572
Pooled Sample Size	95	94	96	94	94	95
Pooled Degrees of Freedom	93	92	94	92	92	93
Critical t-Value (a = 10%)	2.278	2.279	2.278	2.279	2.279	2.278
Calculated t-Value	0.073	0.184	0.394	0.135	0.113	0.123
Accept Alternative Hypothesis?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Article Title	9	9	9	10	10	10
Pooled Variance	1.915	1.663	1.350	2.151	1.694	1.384
Pooled Sample Size	95	95	96	95	95	96
Pooled Degrees of Freedom	93	93	94	93	93	94
Critical t-Value (a = 10%)	2.278	2.278	2.278	2.278	2.278	2.278
Calculated t-Value	0.134	0.136	0.084	0.027	0.228	0.113
Accept Alternative Hypothesis?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Article Title	11	11	11	12	12	12
Pooled Variance	1.347	1.325	0.705	1.580	1.653	1.588
Pooled Sample Size	95	94	95	95	95	95
Pooled Degrees of Freedom	93	92	93	93	93	93
Critical t-Value (a = 10%)	2.278	2.279	2.278	2.278	2.278	2.278
Calculated t-Value	0.029	0.025	0.234	0.100	0.162	0.215
Accept Alternative Hypothesis?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Table 21: Critical value method of hypothesis testing of group 1 vs group 4 for sensationalism section

Group 1 vs. Group 5	Exciting	Interesting	Informative	Exciting	Interesting	Informative
Article Title	1	1	1	2	2	2
Pooled Variance	1.411	1.680	1.464	2.565	1.998	0.736
Pooled Sample Size	79	78	78	78	78	79
Pooled Degrees of Freedom	77	76	76	76	76	77
Critical t-Value (a = 10%)	2.286	2.287	2.287	2.287	2.287	2.286
Calculated t-Value	0.030	0.151	0.329	0.062	0.190	0.136
Accept Alternative Hypothesis?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Article Title	3	3	3	4	4	4
Pooled Variance	1.412	1.120	0.259	1.528	1.494	1.319
Pooled Sample Size	78	79	78	78	79	78
Pooled Degrees of Freedom	76	77	76	76	77	76
Critical t-Value (a = 10%)	2.287	2.286	2.287	2.287	2.286	2.287
Calculated t-Value	0.305	0.353	0.207	0.139	0.255	0.513
Accept Alternative Hypothesis?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Article Title	5	5	5	6	6	6
Pooled Variance	1.858	1.669	1.237	1.624	1.652	0.694
Pooled Sample Size	78	79	78	78	79	78
Pooled Degrees of Freedom	76	77	76	76	77	76
Critical t-Value (a = 10%)	2.287	2.286	2.287	2.287	2.286	2.287
Calculated t-Value	0.100	0.061	0.251	0.405	0.524	0.671
Accept Alternative Hypothesis?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Article Title	7	7	7	8	8	8
Pooled Variance	1.666	1.826	1.396	1.329	1.393	1.556
Pooled Sample Size	77	76	78	76	76	77
Pooled Degrees of Freedom	75	74	76	74	74	75
Critical t-Value (a = 10%)	2.287	2.288	2.287	2.288	2.288	2.287
Calculated t-Value	0.197	0.260	0.562	0.112	0.046	0.042
Accept Alternative Hypothesis?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Article Title	9	9	9	10	10	10
Pooled Variance	$2.029	$1.777	$1.378	$2.271	$1.854	$1.335
Pooled Sample Size	77	77	78	77	77	78
Pooled Degrees of Freedom	75	75	76	75	75	76
Critical t-Value (a = 10%)	2.287	2.287	2.287	2.287	2.287	2.287
Calculated t-Value	0.082	0.092	0.179	0.030	0.216	0.167
Accept Alternative Hypothesis?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Article Title	11	11	11	12	12	12
Pooled Variance	1.278345	$1.253	$0.666	$1.580	1.656091632	$1.664
Pooled Sample Size	77	76	78	77	77	77
Pooled Degrees of Freedom	75	74	76	75	75	75
Critical t-Value (a = 10%)	2.2873	2.288	2.287	2.287	2.2873	2.287
Calculated t-Value	0.0722451	0.062	0.315	0.105	0.123525621	0.171
Accept Alternative Hypothesis?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Table 22: Critical value method of hypothesis testing of group 1 vs group 5 for sensationalism section

It is believed that the failure to achieve statistically significant results for relating pseudoscientific beliefs to sensationalized media exposure was largely in part due to the design of section four of the survey. Ultimately it was the variability in the data rather than the sample size or confidence level that failed to create a link. The fourth section of the survey was effectively seen as no different, and the results did not depend upon who was answering.

Science versus perception.

The survey successfully identified a relationship between pseudoscientific beliefs and perception of science and the media. Following the same methods as with comparing pseudoscientific beliefs to sensationalized media, three key links were made. These were as follows:

1. Individuals who held pseudoscientific beliefs were not as highly exposed to scientific media outlets such as NatGeo, Discovery, and Popular Science versus those with no pseudoscientific beliefs.
2. Individuals who held pseudoscientific beliefs said they kept up with science and/or research less routinely than those with no pseudoscientific beliefs.
3. Individuals who held pseudoscientific beliefs said they saw science as a less important part of their lives than those with no pseudoscientific beliefs.

An important note to these three links is that while only having one pseudoscientific belief showed less of a relationship, having one or more (and every group above that) indeed strengthened the relationship. The results of the hypothesis testing are presented in Table 24 through Table 26. Table 23 is a key for the statements that the respondent rated based upon how much they agree with them. The selected cases are for group 1 versus group 3 through 5.

Statement Number	Statement
1	I watch/read scientific outlets of media. (i.e. Popular Science, IFLS, Discovery, NatGeo, etc.)
2	I keep informed of some form of science or research routinely.
3	I see science as an important part of my life.
4	Science is accurately displayed in the news media and outlets.
5	Science is accurately displayed in TV and movie media.
6	Social media encourages hysteria and sensationalism.
7	Social media serves as a good means of exchanging scientific information to the masses.
8	Media outlets take accountability for misrepresentation or inaccurate reporting.

Table 23: Key for statement numbers listed in Table 24 through Table 26

Group 1 vs Group 3	Statement Number 1	Statement Number 2	Statement Number 3	Statement Number 4	Statement Number 5	Statement Number 6	Statement Number 7	Statement Number 8
Pooled Variance	1.614	1.254	0.774	0.774	0.707	0.535	1.100	0.894
Pooled Sample Size	145	146	146	145	146	145	145	146
Pooled Degrees of Freedom	143	144	144	143	144	143	143	144
Critical t-Value (a = 10%)	2.276	2.276	2.276	2.276	2.276	2.276	2.276	2.276
Calculated t-Value	2.710	3.254	2.522	0.568	1.541	1.341	0.097	1.866
Is Mean Statistically Different?	**YES**	**YES**	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**

Table 24: Results of critical value hypothesis testing for group 1 vs group 3 in perception section

Group 1 vs Group 4	Statement Number 1	Statement Number 2	Statement Number 3	Statement Number 4	Statement Number 5	Statement Number 6	Statement Number 7	Statement Number 8
Pooled Variance	1.411	1.105	0.730	0.695	0.586	0.615	1.247	0.872
Pooled Sample Size	98	98	98	98	98	97	97	98
Pooled Degrees of Freedom	96	96	96	96	96	95	95	96
Critical t-Value (a = 10%)	2.277	2.277	2.277	2.277	2.277	2.278	2.278	2.277
Calculated t-Value	2.306	3.203	2.823	1.873	2.553	0.838	0.096	1.509
Is Mean Statistically Different?	**YES**	**YES**	**YES**	**NO**	**YES**	**NO**	**NO**	**NO**

Table 25: Results of critical value hypothesis testing for group 1 vs group 4 in perception section

Group 1 vs Group 5	Statement Number 1	Statement Number 2	Statement Number 3	Statement Number 4	Statement Number 5	Statement Number 6	Statement Number 7	Statement Number 8
Pooled Variance	1.388	1.018	0.712	0.634	0.544	0.660	1.213	0.904
Pooled Sample Size	80	80	80	80	80	79	79	80
Pooled Degrees of Freedom	78	78	78	78	78	77	77	78
Critical t-Value (a = 10%)	2.286	2.286	2.286	2.286	2.286	2.286	2.286	2.286
Calculated t-Value	2.368	2.671	2.014	0.469	1.260	0.735	0.102	1.638
Is Mean Statistically Different?	**YES**	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Table 26: Results of critical value hypothesis testing for group 1 vs group 5 in perception section

An interesting note in Table 25 is that statement number 5 did in fact have a statistically different mean. That is to say, individuals who had more than one pseudoscientific belief tended to science was more accurately depicted in TV and movies than those individuals who did not hold scientific beliefs. Strangely enough, group 5 did not come to the same result. This very well could be a factor of the confidence level. Given that group 5 has a smaller sample size by roughly 20 respondents, this could have driven the calculated t-value down against the critical t-value. Another interesting note is that in the case of group 1 vs group 5, there was a failure to reject the null hypothesis on statement three that the means were the same. That is to say that as according to the calculations from Table 26, there was actually no statistical difference between the means. Again, this is largely in part due to the smaller sample size altering the calculated t-value down against the critical t-value. Lowering the confidence level down to 85% successfully allows the alternative hypothesis to be accepted.

Results from the demographics.

Since group 3, group 4, and group 5 all drew results about not being as exposed to scientific media, not keeping up with science and/or research as frequently, and saw science as less important in their lives, an investigation into their demographics was necessary. Demographic by demographic, each of the nine questions in the first section of the survey were examined versus the whole population. The median and mode ages were 23 and 22, respectively, for all three cases. Upon removal of outliers, the mean age in all three groups ranged from 22 to 24. As with age, the level of attained education matched as undergraduate students. Much like the entire sample mean, at least one standard deviation of data (68%) contained all undergraduate students aged 18-25 in all three groups. A hypothesized result indeed came true, as gender showed no signs of fluctuation from the overall sample mean inside each of the groups.

Another such mistake was identified in the design process. The choice to allow up to two areas of study in the demographics made it difficult to tell the difference between those who had responded twice versus those who had responded only once (due to software limitations). Additionally, the sample sizes to make conclusions based upon area of study for groups 3, 4, and 5 were too small to be able to produce statistically significant results.

When it came to religious or spiritual activity, more pseudoscientific beliefs had the strongest relationship with increased spiritual activity. At a 90% confidence level, Table 27 depicts how increasing in number of pseudoscientific beliefs (groups 3 to 4 to 5) trends upward with increase in religious activity.

	Group 1 vs Group 3	Group 1 vs Group 4	Group 1 vs Group 5
Pooled Variance	1.590	1.864	1.915
Pooled Sample Size	146	98	80
Pooled Degrees of Freedom	144	96	78
Critical t-Value (a = 10%)	2.276	2.277	2.286
Calculated t-Value	2.483	3.698	4.829
Is Mean Statistically Different?	YES	YES	YES

Table 27: Critical value hypothesis testing for number of pseudoscientific beliefs versus religious/spiritual activity

This trend is most likely to exist because religious or spiritual activity generally contradicts science. Thus, one small conclusion that can be made is that individuals aged 18-24 at the undergraduate level who are generally more spiritual or more religious are less likely to value science, and more likely to have pseudoscientific beliefs.

CONCLUSION

Several sources of pseudoscience have been identified. These include but are certainly not limited to geophysical/astronomical pseudoscientific beliefs, biological pseudoscientific beliefs, and medicinal/drug related pseudoscientific beliefs. Specific pseudoscientific beliefs that seemed to be promoted by a sensational media were gathered from literary review, and a survey was constructed around them.

The survey failed to draw a direct or indirect link between one's ability to dictate science from pseudoscience and a heightened exposure to sensationalized media. However, the survey was still able to come to the conclusion that individuals aged 18-24 at the undergraduate level who are generally more spiritual or more religious are less likely to value science, and more likely to have pseudoscientific beliefs. Another more general conclusion to be met is that people with pseudoscientific beliefs generally do not value science as much as those who do not have pseudoscientific beliefs. Thus, it is seen as somewhat important to target *interest* in science to combat pseudoscience.

APPENDIX

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

University of Central Florida

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1 FWA00000351, IRB00001138**

To: **Joshua E. Colwell** and Co-PI: **Christopher Barsoum**

Date: **September 16, 2014**

Dear Researcher:

On 9/16/2014, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review:	Exempt Determination
Project Title:	Media Sensationalism and its Effects on the Public Understanding of Science
Investigator:	Joshua E Colwell
IRB Number:	SBE-14-10537
Funding Agency:	
Grant Title:	Research
ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual. On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 09/16/2014 06:34:12 AM EDT

Joanne Muratori

IRB Coordinator

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