

# Investigating The Gap Between Public Opinion And Scientific Research In The United States Of America In Regards To Extraterrestrials

*Word count: 4080*

## Abstract

This study of public opinion aims to investigate the gap between public knowledge and beliefs surrounding topics related to extraterrestrial life and scientific consensus by comparing and contrasting the results of a randomized survey with related scientific studies and data. The topics investigated were the likelihood of alien life, mental pictures of aliens, and perceptions of the scientific basis of astrobiology, the study of aliens. Respondents were also asked to identify the sources of information that most impacted their perceptions of aliens to add context to their responses and inform the resulting analysis. It was revealed that there are indeed significant gaps in public understanding in the areas of study, which were promptly defined and characterized. Most notably, a new model is proposed for understanding conceptualization of the question ‘What is the likelihood of alien life?’, a response to inconsistencies between survey data and existing methods of probabilistic analysis.

## Introduction

Aliens have fascinated the public imagination ever since the concept of extraterrestrial life entered humanity's collective awareness. Even as early as the second century AD, before the development of the heliocentric model core to today's understanding of extraterrestrials in the spheres of science and pop culture alike, humans were thinking about what life outside of earth could look like, although mostly in a mythological sense (Williams, 2016).

Science fiction in our modern world continues this legacy of imagining extraterrestrial life, filling the gap between the known and the unknown and taking over where science has yet to stake out definite territory (Sutton & Sutton, 1969). We currently have very limited scientific data on potential extraterrestrial life, and it is this factual vacuum that gives rise to rich and diverse interpretations of extraterrestrials in media. Unfortunately, along with this come widespread misconceptions and assumptions deeply rooted in fictionalized depictions of alien life.

In this way, fictitious depictions of aliens serve as a modern mythos, with far-reaching effects on public thought and human society as a whole; just take the infamous (however often over exaggerated) 1938 'War of the Worlds' panic, where Orson Welles allegedly fooled the American public into believing that an alien invasion was in progress with a dramatized reading of H.G. Wells' science fiction masterpiece stylized to appear as a genuine newscast:

*"Ladies and gentlemen, I have a grave announcement to make. Incredible as it may seem, both the observations of science and the evidence of our eyes lead to the inescapable assumption that those strange beings who landed in the Jersey farmlands tonight are the vanguard of an invading army from the planet Mars."*

(Columbia Broadcasting System, 1938)

Although the public reaction was far from the chaos reported by newspapers at the time, this simple broadcast had around 20 percent of viewers genuinely believing that Martians had invaded America, from frantic calls to the local police station to anecdotal tales of alarm and confusion (Lovgren, 2005). These 20 percent may have felt more secure knowing that, from a simple extrapolation of the Drake equation, astronomer Seth Shostak came to the conclusion that the nearest aliens (in this context, technically adept intelligent life) are likely 1000-2000 lightyears away, a distance that our most advanced rockets would take at least 20 million years to cover, making an alien invasion highly improbable (Shostak, 2018).

With this in mind, it is imperative that public opinion is assessed in order to form a holistic picture of the beliefs of the non-scientific community regarding all forms of potential alien life and opening up the possibility for intervention. The following aims to address this need, surveying Americans on their opinions on five topics relevant to the search for extraterrestrial life, with a special focus on common misconceptions and the potential influence of popular culture depictions of aliens.

## Literature review

Disparities between science and society are not just isolated to aliens; in fact, the entire field of study surrounding science communication is based upon finding innovative ways to bridge this gap. A University of Newcastle paper defines science communication as,

“...the use of appropriate skills, media, activities, and dialogue to produce one or more of the following personal responses to science: Awareness, Enjoyment, Interest, Opinion-forming, and Understanding.”

(Burns, et.al.)

One of the most significant challenges currently facing science communicators worldwide is moving away from the deficit model, a dated science communication theory that aims to educate the public by meeting an information ‘deficit’ (Astbury, 2017). This model assumes that misunderstandings of and hostility towards scientific research and findings simply arise from a lack of information, as opposed to more persistent issues such as ideological conflicts and a lack of public involvement in scientific decisions .

Replacing this outdated system with a new, more holistic model of scientific engagement will require an informed approach, and a strong understanding of psychology and existing opinions and beliefs surrounding scientific issues in question that enables science communicators to accurately assess barriers to creating an educated public. This is especially relevant when dealing with a concept such as extraterrestrial life that is already so deeply entrenched in popular culture rife with misrepresentations.

The repercussions of poor science communication resonate farther than one might think. In *Science Communication as Political Communication*, Sheufele even asserts that, “some of the most polarizing topics” in American politics are, in fact, scientific ones (Sheufele, 2014). Scientific work has real world effects, and when the public are not successfully engaged in scientific policy and developments, we experience the consequences, whether that be the tragedy and controversy of the Manhattan Project, or the ongoing struggles and miscommunication surrounding Fukushima’s nuclear meltdown.

Science communication also has effects on budget allocations and financial support for scientific programs, crucial amidst slashes to NASA’s 2020 budget that will drastically limit innovation and possibilities for growth (Weitering, 2019). A 2015 Pew survey showed that respondents with higher general knowledge of science are more likely to support basic science funding (Pew Research Center, 2015). These are the individuals that will elect future government officials, and control whether or not budgets address the needs and goals of both the scientific community and society at whole. Clearly, it is essential that misunderstandings and misconceptions are effectively identified and addressed, and that a healthy dialogue is constructed between researchers, policy makers, and the public.

In 2015, YouGov conducted a four question poll investigating the beliefs surrounding extraterrestrial life of individuals in Britain, Germany, and the USA with similar goals. The results, while informative, largely ignored the possibility of ‘unintelligent’ extraterrestrial life, despite the fact that, “simple microbial life would be statistically more common in the Universe than any type of advanced extraterrestrial intelligence”, considering the progression from simple to more complex life (Foucher, et.

al.). The YouGov survey in of itself perfectly demonstrates ignorance of the very realistic possibility of simple, perhaps microbial extraterrestrial life, compared to a public fixation on intelligent and technologically advanced alien civilizations like those the Drake equation deals with, something this study hopes to address.

## Methodology

This study uses a simple four question cross-sectional survey to assess public opinion on four issues related to extraterrestrial life (Louvrakas, 2008) providing a descriptive ‘snapshot’ of the population in question and their momentary beliefs and values, enabling a quick turnaround of results and the ability to take action based on findings.

Questions were selected based upon:

- A) Importance in the field of astrobiology
- B) Impact in the public sphere (likelihood to influence politics/budget cuts/important science related decisions)
- C) Prevalence of related misinformation in media

## Questions

Questions are displayed below as they were in the survey.

(1) What do you think the likelihood of alien life is?

- Impossible- 0%
- Extremely unlikely- 12.5%
- Very unlikely- 25%
- Unlikely- 37.5%
- Even- 50%
- Likely- 62.5%
- Very Likely- 75%
- Extremely Likely- 87.5%
- Certain- 100%

*This is one of the biggest questions being asked in astrobiologist circles, evidenced by the fame and widespread usage of the Drake equation, and thus ranks very highly in my first criterion. Public belief in the likelihood of extraterrestrial life also ranks high in my second criteria, because individuals who don't believe in the possibility of extraterrestrial life are less likely to support research spending tax dollars to search for it. Finally, my third criteria is satisfied as the media representation surrounding the probability of extraterrestrial life varies immensely and is rife with misconceptions, from the television show 'Ancient Aliens', which is lent a certain perceived credibility by its place on the History channel despite unscientific claims that rely on the existence of intelligent life, to religious programming and media that all but denies even the possibility of life outside of earth.*

(2) When you imagine an alien do you picture:

- Something completely unfamiliar to human experience
- Something similar to earth microbes
- Something similar to humans
- Something similar to animals
- Something similar to depictions of aliens in the media
- Other (please Specify)

*This question aims to get a general picture of what people visualize when they think 'alien'. In regards to my first criteria, these questions are hugely important because they dictate the process of the search for life, essentially what you are looking for in the first place.*

*The impact in the public sphere is more subtle, but nevertheless important. This question relates more to expectations and attitudes; If most members of the public are expecting life similar to humans, finding a microbe on Mars could seem inconsequential. Being properly informed will mitigate this. This question is most clearly related to the third criteria. One clear discrepancy between media and science in this realm is the tendency to have aliens take on humanoid appearance, or, at the very least, that of a complex organism that could be compared to earth animal life. Where are the alien microbes? The principles of Darwinian evolution coupled with a healthy dose of common sense would lead one inevitably to the conclusion that before complex life evolves, simple life must too.*

(3) Do you think that astrobiology, the study of aliens, is:

- Strongly based in science
- Moderately based in science
- Weakly based in science
- Completely un-based in science

*While some astrobiologists might occasionally experience a crisis of faith in the scientific basis of their work, this question is mostly selected based upon its relevance to the second and third criteria. It is essential to understand public perceptions of the study of aliens itself, and whether or not laymen believe the study of aliens to even be scientific. This question, along with the fourth one, contextualize the first two questions and provide insight as to how these ideas are formed.*

(4) What factors most influence your perception of aliens?

- Scientific papers and databases
- Science Journalism (Scientific American etc)
- Pop culture (sci-fi novels/movies)
- Organization websites (nasa.gov etc)
- Social media
- Other (please Specify)

*This question serves to contextualize test subject's answers by inquiring into their media consumption habits and was not selected based upon the criteria but rather to serve the aforementioned purpose.*

## The Survey

The survey was completed by a randomized sample of 200 individuals in the United States of America via Google Surveys. The order of questions is reversed or randomized for every responder based upon whether or not that will affect the comprehensibility of the question. There are no screening questions and some open-ended questions give respondents the opportunity to select 'other' and enter an alternate response to the given options.

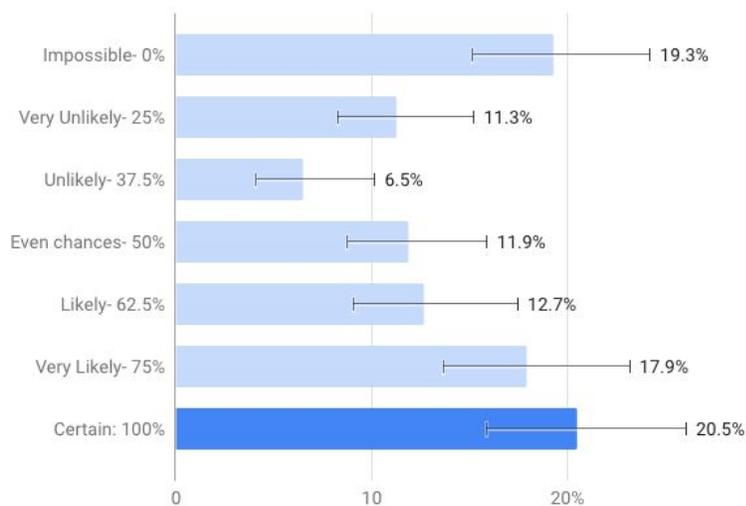
In this survey, the word 'alien' is used instead of 'extraterrestrial life' to maximize comprehensibility and avoid filtering results based upon existing knowledge of the topic at hand.

## Methods of Data Analysis

Results of the survey will be compared and contrasted with scientific evidence to measure the gap between public opinion and scientific research. Based off of this, an action plan can be formulated to mitigate repercussions of this gap and begin to close it.

## Survey Results

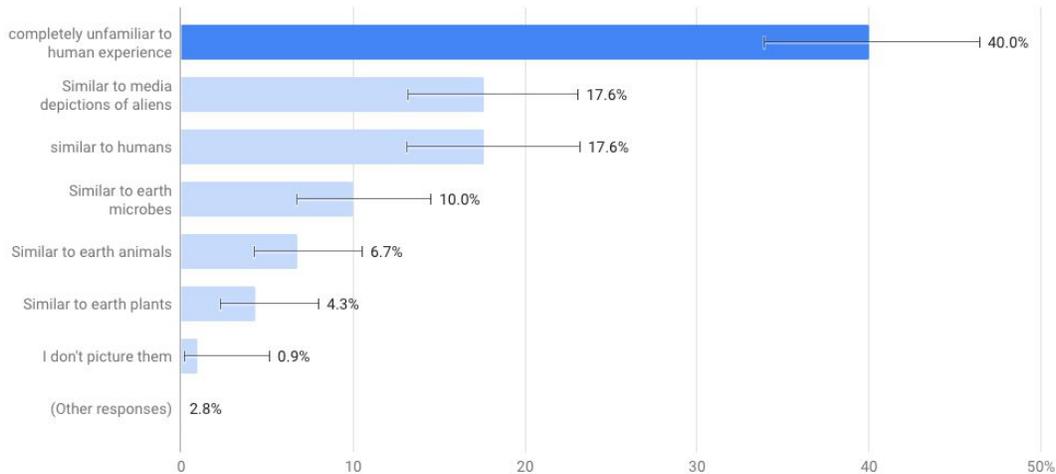
*Figure 1: Opinion on the likelihood of extraterrestrial life.*



The most striking thing about this data is the tendency towards extreme, polarized views surrounding the likelihood of extraterrestrial life. The most selected response was 'Certain: 100%', with 'Impossible- 0%' closely following as the second most selected option. This suggests that generally laymen tend to see the question of extraterrestrial life as very black or white, and be very sure of their position. In contrast, you would be hard-pressed to find a scientist who would choose either extreme option without the evidence to support their view, which as of yet is very difficult to find.

Overall, responses trend towards the likelier end of the spectrum, with 51.1% of respondents predicting high likelihood, compared to 37.1% of respondents who predict a low likelihood and 11.9% resting at even chances. This shows that generally Americans are open to the possibility of extraterrestrial life.

Figure 2: Mental picture when imagining an alien.

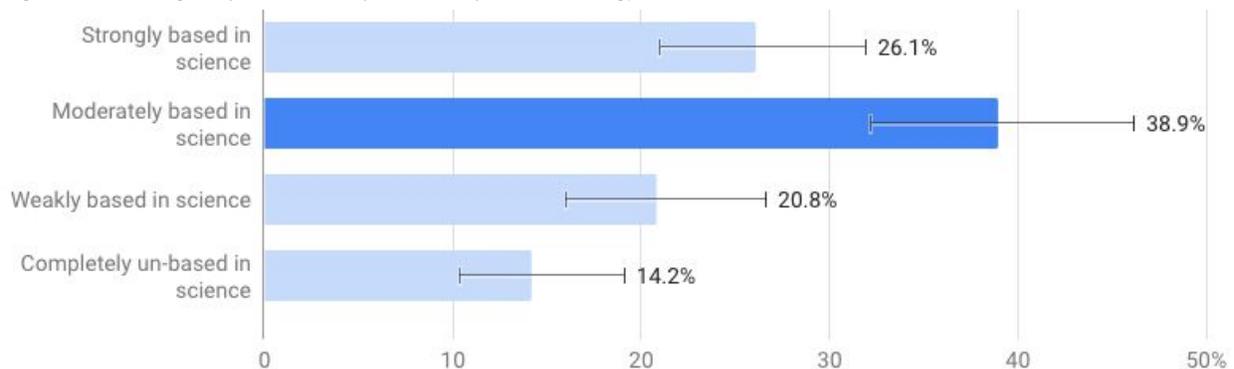


By far, the most selected answer at 40% was ‘completely unfamiliar to human experience’. This makes sense in the context of concrete information on alien life being difficult to find. ‘Similar to media depictions of aliens’ and ‘similar to humans’ together are the second most popular options. Due to anthropocentric bias in most sci-fi media these two options have a lot in common and represent an imagined alien in humanity’s own image.

Including ‘other’ responses, less than 3% of respondents replied that they did not picture aliens or did not have an image in their mind of what an extraterrestrial could look like. This level of engagement is very promising, and suggests that most individuals can and do engage with the idea of alien life on some level.

Only 10% of respondents selected similar to earth microbes, however the correlations between this question and others (discussed later in the paper) shed some interesting light on this finding.

Figure 3: Strength of the scientific base of astrobiology.



This graph shows that most respondents see astrobiology as moderately based in science. Generally, responses express a positive response to the scientific basis of astrobiology as opposed to a negative response, with 65% of responses expressing a stronger scientific base and only 35% expressing a weaker scientific base.

Figure 4: Strength of the scientific basis of astrobiology (18 to 34 year olds).

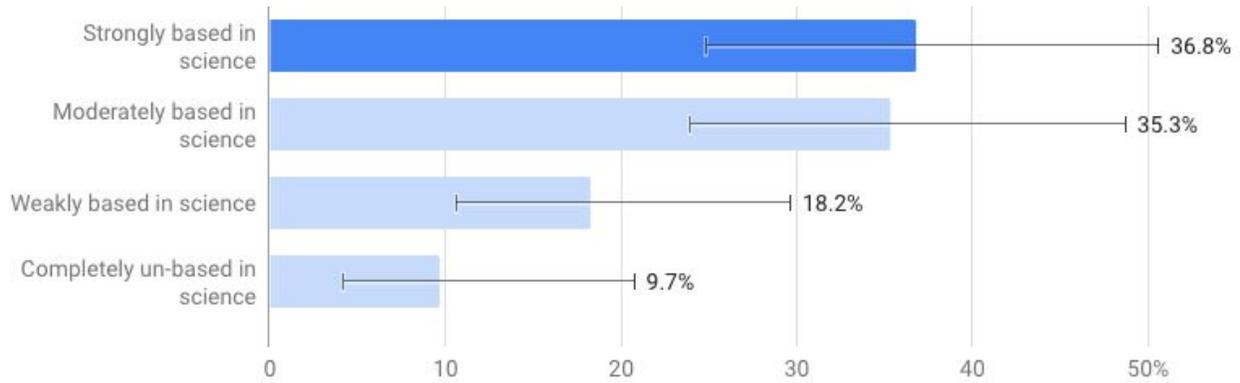
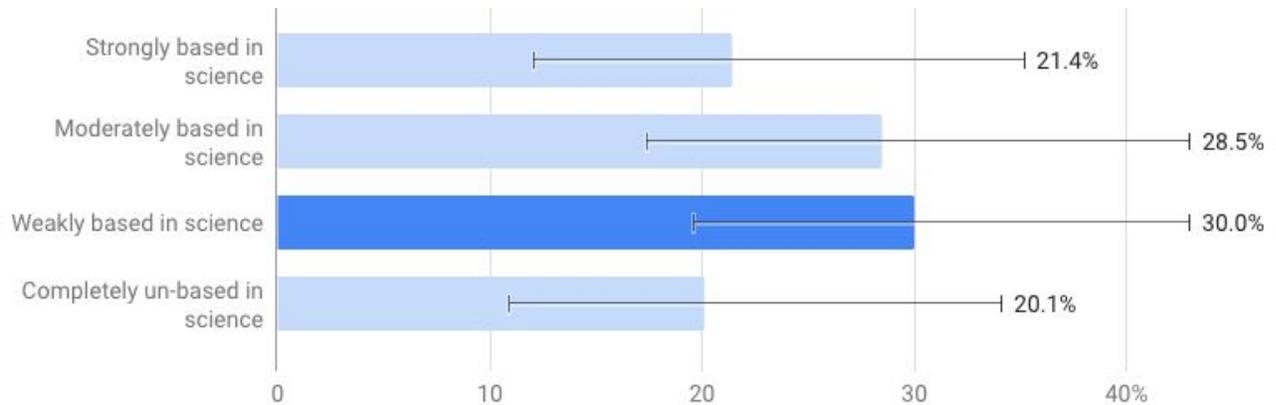
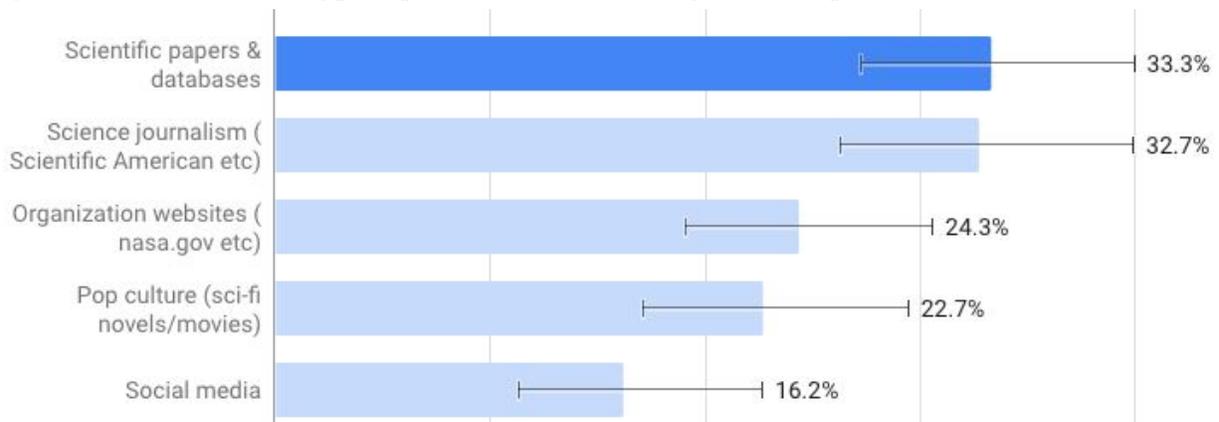


Figure 5: Strength of the scientific basis of astrobiology (55+ year olds).



In figures four and five, the responses are filtered via age, with the first graph (fig. 4) showing respondents aged 18 to 34, and the second (fig. 5) showing those aged 55 and over. Compared to all responses, younger respondents tend to have more confidence in the scientific basis of astrobiology, where as those over 55 had the lowest confidence in astrobiology out of all age groups.

Figure 6: Factors influencing perceptions of aliens excluding 'other' responses.

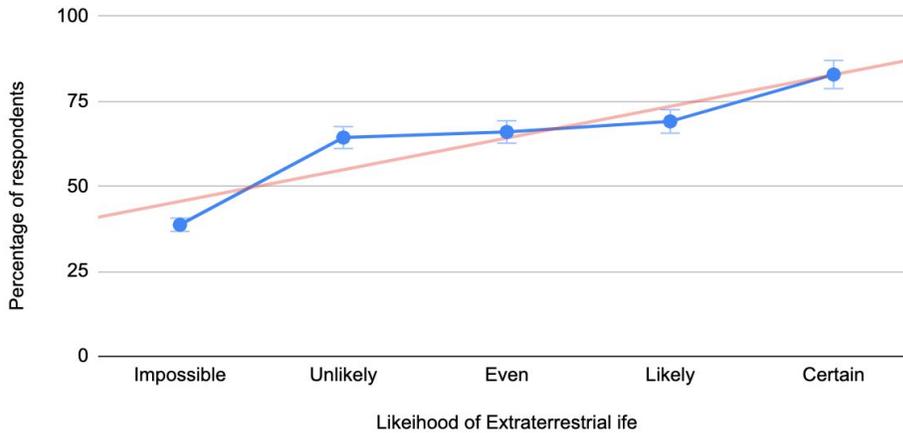


Credible sources such as scientific papers and databases, science journalism, and organization websites like nasa.gov take the lead in factors that influence respondent's perception of aliens. Pop culture

and social media rank lower, and in ‘other’ most responses cited religious justification for their beliefs or general intuition. In the charts below, this information will be used to contextualize some of the previous questions.

*Figure 7: Factors influencing perception of aliens compared to belief in the likelihood of extraterrestrial life.*

Percentage of Respondents with Credible Sources as Factors Influencing Perception of Aliens Compared to Belief in Likelihood of Extraterrestrial Life.

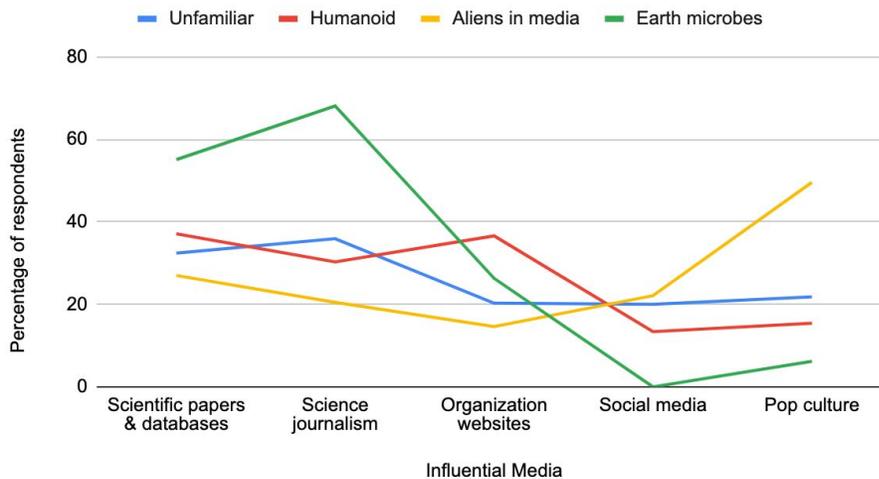


In the above chart, respondents who reported scientific papers and databases or science journalism (designated as ‘credible sources’) as factors influencing their perception of aliens are isolated and divided based upon their answer to Question 1: ‘How likely do you think alien life is?’.

As displayed in fig. 7, respondents believing in a high likelihood of alien life tend to rely more on credible sources, while those believing in a low likelihood of alien life rely less on these credible sources. Generally, the trendline suggests that the more likely one is to base their perceptions on credible sources, the more likely one is to have a strong belief in the likelihood of aliens.

*Figure 8: Factors influencing perception of aliens compared to mental image of aliens*

### Mental Image of Aliens Compared to Most Influential Media



In fig.8, respondents mental image of a potential alien is compared to the factors that influence their perception of aliens.

Take earth microbes, for example. Immediately it is apparent that those who picture aliens as similar to earth microbes tend to be influenced more by scientific papers and databases and science journalism, on the more credible end of the media spectrum. These individuals are also less likely to be influenced by social media and pop culture. On the other hand, individuals who believe that aliens would be similar to those seen in movies and on TV are far more likely to be influenced by social media and pop culture than more credible sources like science journalism and organization websites. This suggests a correlation between what media and individual is predominantly influenced by and their mental image of what an alien might look like.

#### Data Summary:

To conclude, the survey has revealed that the likelihood of alien life is a polarizing question, with the two most popular results being 'Certain', closely followed by 'Impossible'. Generally, however, respondents tended to be more optimistic than not.

The vast majority of us picture alien life as something completely unfamiliar to human experience, or as something similar to humans and what we see in popular culture. However, those who rely on scientific papers and science journalism are more convinced that the first extraterrestrial we find might be microscopic, and similar to microbes on earth.

Most individuals see astrobiology as moderately based in science, but younger people are more likely to see the study of aliens as more firmly scientific, whereas older ones have trouble seeing it's scientific basis. The factors that influence perceptions of aliens see credible sources like scientific papers come out on top, with pop culture and social media rounding out the bottom. The credibility of sources that respondents relied upon most heavily had an effect on their belief in the likelihood of alien life, and their mental image of what an alien might look like.

## Analysis

This section will compare and contrast the findings of the survey with credible and up to date scientific resources with the goal of defining a gap between scientific knowledge and public opinion that can then be used to develop an action plan to strengthen communication between astrobiologists and the public.

### Likelihood of Alien Life

One very important measure of the likelihood of alien life, that has been mentioned at various points throughout this essay, is the Drake Equation.

*Figure 9: Modified Drake equation*

$$P_{\text{Life}} = P_{\text{ast}} \times P_{\text{bt}}$$

As seen in fig.9, the Drake Equation takes the product of astronomical factors ( $P_{\text{ast}}$ ) such as the rate of star formation, and biotechnical factors ( $P_{\text{bt}}$ ) such as the rate of life occurring on a habitable planet. The resulting  $P_{\text{Life}}$  provides us with a best estimate of the probability of life in the universe. As  $P_{\text{ast}}$  is now sufficiently constrained to the consensus of the scientific community, the exact value of  $P_{\text{bt}}$ , the biotechnical factors, is subject to much debate.

After lengthy attempts to convert the probability percentages selected by survey respondents into a form that would be comparable to different scientific papers speculating on  $P_{\text{bt}}$  and consequently  $P_{\text{Life}}$ , I came to the conclusion that the key indicator of the gap between a scientific and a general approach to the likelihood of alien life is in the conceptualization of the question itself. When an average member of the public approaches the question of extraterrestrial life, the question is very dualistic in nature; either aliens exist, or they don't. When they ask what the likelihood of alien life is, they are really asking, 'Is there one other example of life in the universe outside of earth?'. When an astrobiologist asks what the likelihood of alien life is, they ask, 'Given any habitable planet, what is the probability that life arises?' (analogous to  $P_{\text{bt}}$ ).

*Figure 10: Comparison of General and Scientific Conceptualization of Likelihood of Alien Life*



The biggest gap between science and public perception is in the relevance of simple life like microbes to the search for life. Many people don't even think about alien bacteria (In this survey only 10% reported microbes as how they picture alien life), but microscopic life could exist as close as Mars, and microbes have a far more expansive habitable region than complex multicellular life. In fact, finding alien prokaryote like life could be as much as 560,000 times more likely than finding a civilization at a similar stage to humanity today.

The third and fourth questions were not put forward for compare/contrast analysis as their primary purpose was to provide context to prior questions.

## Evaluation & Limitations

The biggest limitation of this study was its scope. The amount of responses was limited by cost to only 200. This limited the validity of the survey as a measure of public opinion and led to a comparatively large margin of error and occasional inconclusive results. Furthermore, when answers to two different questions were compared or when data was divided by age or gender, the margin of error increased immensely to the point where very little conclusions could be taken.

## Discussion

### **Suggestions for Further Research**

As the margin of error and low sample size has rendered these results inconclusive, a more ambitious survey with similar goals is recommended, with expanded scope and questions. Misunderstood fields other than astrobiology such as nuclear physics could also benefit from this type of analysis, where the gap between public and scientific views is defined and characterized.

### **Conclusion**

In conclusion, while pervasive misconceptions remain, a path to closing the gap between science and public perception in regards to extraterrestrials has now been laid. Key concerns have been assessed and characterized with the primary goal of addressing them in the near future.

This study has also revealed a well of potential. Most respondents demonstrated engagement and interest in the topics of the survey, and a rich well of imagination and thought was unearthed, a resource that scientists would do well to take advantage of.

The questions that have been asked in this study take a step away from the problematic deficit model, not just asking what the public doesn't know, but why they think the way they do. It is the author's hope that this type of analysis will become a bigger part of the science communication process, and aid communicators in making better informed decisions for the collective good of scientists and the public alike.