

A Question of Organization: How NASA Expedition 45 astronauts' Twitter feeds compare to the Twitter feeds of basketball stars

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Introduction

This study will seek to understand how NASA astronauts fit into the wider social media community of Twitter. To do this, the Mycelium Model of Public Opinion was used and adapted to modern social networking communication systems. The traditional model looks at the interpersonal interactions of people and how they interconnect to form the general public consensus on various topics (Sereno and Mortensen, 1970). The adaptation will see the people's need for communication drive the interpersonal communication. These interactions will take place in the online medium of Twitter and form narrow silos of interest. These two aspects of communication will manifest as content on Twitter. This content will take the form of a Logos, Pathos, or Ethos lens based on the needs for the individual interactions. All of these different connections across different silos of interest and needs will form the broader messages that make up the full network of the communication medium Twitter.

To better understand this model, an analysis of NASA astronauts and a NBA franchise's players will be performed. These are both large bureaucratic organizations, and they have a comparably small group of people that are the main public face of the organization. The organization and their representative opinion leaders also have a select group of followers who, for their own needs of Pathos, Logos or Ethos, connect with the opinion leaders and other likeminded individuals. The 2014-15 basketball season and finals closely coincide with the Expedition 45's stay on the International Space Station. Astronaut Scott Kelly spent a year in space starting in March, 2015 to March, 2016, and Kelly was active on twitter during his stay on the International Space Station. The twitter activity of the Rockets players James Harden and Ty Lawson will be compared to the Expedition 45 crew members'

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Scott Kelly and Kjell Lindgren's Twitter activity. Kelly's followership and Lindgren's are close to having an equivalent difference in size to Harden's and Lawson's followership.

The metrics were analyzed in three main categories: (1) Reach, (2) How prolific the subject's use of twitter is, and (3) audience engagement. A ratio was used to help account for the popularity differences of sports and space. The conclusions drawn from this research can help evaluate NASA's #yearinspace campaign by comparing it to the effectiveness of a popular sports franchise at the height of its success in a season. This research will also help add to the small body of space communication research that pertains to non-crisis communication about space. The Goal of this study will be to better understand NASA's communication effectiveness when comparing it to organizations that are not in the science or government field, but are still similar structurally. Mechanisms have been developed to make this comparison which could prove useful to future research. This includes the modernized Mycelium Model of Public Opinion.

While there is sufficient understanding where NASA and its astronauts stand in the area of political public opinion, there is little research on where NASA stands in the great arena of the mass media. Given the levels of known popularity but lack of public support how does NASA communication inject itself into the greater public conversation and does it have any effect on public opinion. These are questions which move well beyond the scope of any one study. The lack of research in this direction of NASA communication is the problem and it exists for two overarching reasons. First, most research has been focused on the agency's handling of crises, and second given the understanding of low political support of NASA, researchers would not be concerned with such a small segment of the population. NASA, on the other hand, could greatly benefit from this type of research but cannot undertake it itself.

Literature review and theoretical framework

The theoretical framework of this study is the Mycelium Model of Public Opinion which states that the main force which drives what the message content in media is the interconnected networks of interpersonal communication. The world of Twitter both amplifies and shortens this effect on the content of communication messaging from both individuals and large brands. The amplification comes from the greater audience size of direct messaging and the content maker to content maker nature of social media. The effects are smaller due to the fact that communication on one given subject or ideological opinion begins to sound in an echo-chamber of an audience only interested in one given subject (Shin, Pang, and Kim 2015). However, ideas of what a public is and thus what their opinion can be and how universally it can be held are questions still under consideration today. One area of focus among those interested in public opinion is how does mass media affect the ubiquity of the “mob’s” opinion (Glynn and Hoge 2008).

Currently, there are overarching frameworks under which public opinion is conceptualized. The first, developed within the marketplace of ideas by John Stuart Mill and championed by artists and statesmen like John Milton and Thomas Jefferson. This system is predicated on the notion that in a free and open discussion the best ideas or the truth will win out. This idea was brought to its current incarnation with the operationalization of surveys, monitoring of political opinion, and electoral outcomes (Glynn and Michael 2008). The second framework of public opinion can be seen through the social force of interactions with the mass media and interpersonal interactions between people. This is the core of the Mycelium Model of Public Opinion, the normative force in society helps keep things moving in more or less one direction. This means powerful forces can turn the ship of public opinion, even to the point where public opinion is held against its own interests. This means the “mob” can be

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moved against themselves or some smaller groups even if it undermines the long term welfare of society.

Clearly, these two ways of thinking of public opinion are not incompatible and likely coexist in some kind of mass tug of war between the “mob’s” Pathos and Logos. As the 20th century gave way to the 21st, the proliferation of information both public and private has been a progressive force for political powers’ enfranchisement. With this new power of content creation and distribution, it is important to consider how private and government entities will leverage these communication pathways to move or be moved by public opinion. The consideration of these underlying forces in communication for both the Astronauts & NBA plays, and their audiences will be central to looking at the data of this study (Riel and Cees 2013).

NASA and NBA

In the report “Pathways to Exploration: Rationales and Approaches for a U.S. Program of Human Space Exploration” National Academy of Science, (2014) briefly analyzes the public opinions of space exploration. It was found overall the likeability of NASA is very high; however, stanch support, knowledge, and engagement with the program is only in the 10th percentile of the American people. There is somewhat of a double standard of public opinion of NASA that has run the course throughout the agency’s history. Support for the agency and its performance remains very high (Launius 2003). However, this is in conjunction with the public’s desires to see NASA receive less funding and not pursue new ambitions like human missions into deep space such as landing on Mars. This attitude was also true in the 60s. The public supported NASA’s performance, but the majority of Americans did not want to make the financial effort to land on the moon. It is also noted that there is an extreme disconnect between public knowledge and the reality of NASA’s budget. The lifetime agency average of

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federal spending on NASA is one percent of the federal portfolio. Today, it's less than 0.5 percent, while only 10 percent of the general public knows this fact and 90 percent think it is much higher (Launius 2003). There are notions the space community has about recapturing the mythological memories of overwhelming support the public once had such as, during Apollo that will help drive NASA forward once again. But, even then, the driving force behind the Apollo program was the Cold War rivalries between the United States and Soviet Union (Launius 2003). It is important to note the view of Cold War rivalries being the catalyst for the moon shot is a widely accepted one in the historical community. Within the agency there are struggles for limited resources and control of the operational structure of the various programs. After the loss of Space Shuttle Columbia, these issues were examined in the paper Garner (2006). Using the analysis of systemic failures in management might be beyond the scope of NASA's office of communication. However, with the limited budget of NASA's communication offices these internal struggles for control and resources must have a similar effect on the efficacy of NASA's strategic communication efforts.

Kay (1994) states that all NASA's plans must have tangible short term incremental benefits to the country as a whole. NASA's problem is for it to make things or do things that are a direct benefit it must undertake large scale programs requiring a decade or more to accomplish. The larger a program and the greater the time scale, the more likely a failure will take place and this will cripple all support for that program. If support is lost due to a failure within the program, regaining that lost support may be impossible. These effects of public support and technology feedback create a catalyst for engagement with the general public. How to generate content the public will perceive as palatable is an area that looks into esthetics. These figures and information help give an understanding of the Mycelium Model's effects on the need for and type of communication undertaken by NASA.

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The content of astronaut's and Basketball player's twitter are very different (Smith, Sanderson 2015), (Smith, Smith, Arcand, Smith, Bookbinder and Keach 2011). The perceptions people were found to have of the Astronomy Photo of the Day (APOD) on NASA.gov were differed along the lines of laypeople and experts. The laypeople had similar viewing habits to visitors in at an art museum. The gratifications of viewing the images were thoughts of awe, wonder and appreciation (Smith, Smith, Arcand, Smith, Bookbinder, and Keach 2011). The image from the NASA APOD is very different in many cases from the Twitter feeds of astronauts. The APOD is an image of the cosmos and celestial phenomenon. In comparison the astronauts' feeds have images of people, and images of the Earth.

The world of sports has some organizational similarities to that of NASA, mainly its national size and bureaucracy. The differences are numerous. The largest difference is the fan base. As a measurement of popularity and support consumer spending on sports in recent years has increased to 2 percent of Gross National Product (GNP) (Lera-Lopez and Manuel 2007). The demographics of sports participation and spending were predominately male. Predictably, the participation and consumption rates of sports were correlated (Lera-Lopez and Manuel 2007) with the level of participation dropping as subjects entered into the work force, but not consumption (Lera-Lopez and Manuel 2007). It is important for sports spectators to feel self-fulfillment or achievement when watching sports in order for the attachments to remain strong enough for them to feel a return on the investment of time and money. There are few similarities to the gratifications people get from engagement with NASA or its astronauts (Smith, Smith, Arcand, Smith, Bookbinder and Keach 2011). There are lessons to learn from the attachment points spectators get from observing sporting events. Mainly there must be a positive return on the investment of the individual's interest (Kay 1994).

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Athletes' Twitter content is very different from anything NASA or the astronauts produce. Athletes produce content geared towards defining themselves, promoting their personal brand and their teams (Smith and Sanderson 2015). Much of the images on professional athletes' twitters and Instagram accounts involve friends and family as well as images of achievements with team mates. This helps define themselves outside of traditional media and give their fans a direct link to their lives (Smith and Sanderson 2015).

The dual nature of dialog and persuasion have naturally found their way into social media like Twitter (Theunissen 2015). The virality of content on these platforms is contingent on not only how many people are reached but the interactions which take place between content makers and consumers (Alhabash and McAlister 2015). Fans look at the athletes social media content for purposes of positive and negative reinforcement. These gratifications fall under the categories of vicarious achievement, interaction, drama, and catharsis (Smith and Smith 2010).

The reasons why content is produced and consumed have some similarities to that of NASA's astronauts. There is a clear need to promote the "brand" of space exploration and NASA through dialog and persuasion (Alhabash and McAlister 2015), (Theunissen 2015). The consumption of content from athletes and astronauts has an entertainment component to the viewer's desires, but clearly the research shows the entertainment is for different reasons (Smith, and Smith, 2010) (Smith, Smith, Arcand, Smith, Bookbinder and Keach 2011). The research of Hall (2015) goes so far as to call the fascination with sports hedonistic entertainment. Wang (2015) found that interaction at or during a sporting event stems from a desire for interactivity with other likeminded fans and competition with fans of the other team. This is in contrast to the feelings of awe the layperson reported from looking at the NASA APOD (Smith, Smith, Arcand, Smith, Bookbinder and Keach 2011). The vicarious experience

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of competition and finding likeminded allies in the sports community is one of the primary reasons people use social media to engage with sporting events. This network can serve as a support group when a team does not do well and a means to exalt triumph when the favored team wins.

In regards to garnering more public support, both NASA astronauts and professional basketball players have the same goal, with different purposes and methods. Most notably, the support astronauts seek is public political support. A study examining the political and social movements of the recent half-decade found that these movements have relied heavily on social media but that social media was not necessarily the driving force of these movements (Bastos, Mercea, Charpenter, 2015). Rather, social media is a networking force which can link many local movements into one national movement. While far removed from political social struggles, both astronauts and professional basketball players seek public attention and mobilization of engagement on social networks which is an attainable goal with the use of social media (Bastos, Mercea and Charpenter 2015). This is where the media and content aspect of public opinion and Mycelium forces come into play in the communication loop of Twitter. The reasons why the Players and Astronauts use social media are different, made so by the underlying needs of themselves, their organizations, and the people they are trying to reach (Riel and Cees 2013).

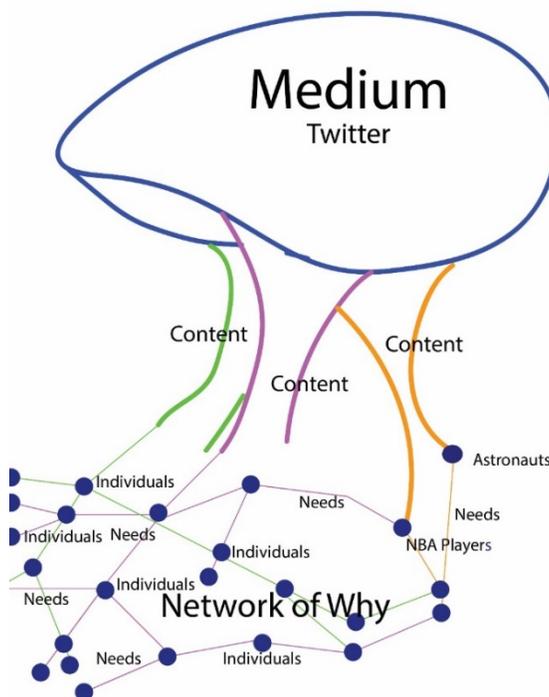
We don't see overt advertising or promotion from NASA or the NBA through their opinion leaders. What is manifest from the opinion leaders and spokes person's behavior is the needs of the opinion leader and their organization. When an opinion leader's needs are met through online communication vicariously so too are the organizations. Selected for this study are the NASA astronauts and the NBA players of the Houston Rockets. Thus the agenda is set for the media that will be generated by these individuals.

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The larger question at hand is how will the audience grow and be maintained in the world of long distance mycelium interactions and give the audience power to pick their content generators. This is due to the relatively one way content generation from opinion leader to audience found on Twitter (Theunissen P. 2015), (Zhang, Mimi, Jansen, Bernard, Chowdhury and Abdur 2011). The community that forms around these two groups of opinion leaders is where the content to content creation truly takes place (Alhabash and McAlister 2015), (Theunissen 2015), (Bastos, Mercea and Charpenter 2015). The social media version of the mycelium model has the strength to drive a conversation from the opinion leaders content to content generated from their respective audiences (Moquail and Windahl 2013).

This is where a Web 2.0 Mycelium model can come into play to help understand the underlining structure of the current process at play with astronauts and NBA players (Riel, Cees 2013). In this new model the silo nature of both the Mycelium and fungi must be taken in to account (see figure one)

Figure 1: Web 2.0 Mycelium model



This is due to the selective nature of social media. The audience can decide what content they want to see via the choices of whom they follow. Further the scale of the social network is increased while the subject is simultaneously decreased. This is more so for individuals who follow NBA players, since the competitive nature of sports creates its own silo effects to the various cities that have sports franchises (Wang 2015), (Smith and Smith 2010). A similar silo effect happens for aerospace

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enthusiast. The difference is the locality of the audience is global yet the niche content generated by opinion leaders and dialog among the public it creates a more closely knit community in which some fictionalization occurs. IE. Crewed and uncrewed exploration, private and public investment in space, moon or asteroid. These segments are not part of the study, but it is important to note their existence since it has some resemblance to the rivalries of sports teams (Kay 1994). These separated mycelium have some overlapping, however they generate their own individual stocks of the fungi which represents the content. The connections of the mycelium represent the needs, uses, and gratifications of why different individuals communicate and who they communicate with. In the case of social media the networks of individuals find a common why and thus form a community network. Into this network are the opinion leaders, where their why is different from the audience groups' therefore their content is its own fungi stock that hopes to fulfill their specific needs to start audience interaction around their brands. Finally the cap on the fungi is the medium in which all content is seen. In this case Twitter.

Twitter is the most successful micro blogging social networking service in the world with on average 300 million active monthly users. The medium of communication is a 140 character message with the added ability to embed links, pictures and videos. These messages are known as tweets and subscribers can send messages out for any other subscriber to see and follow other subscribers to review notifications about newly generated content. The number symbol (#) is used in front of phrases like #clutchcity or #JourneytoMars. These so called hashtags can be searched and make joining relevant conversations to the user simpler.

When looking at how to communicate via Twitter the study Zhang, Mimi, Jansen, Bernard, Chowdhury, and Abdur (2011) found that tweets had a life cycle of generally 1.5 to 4 hours. Any

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consumer interaction with the brand would only occur to the second-degree of interaction. In other words the brand will interact via a tweet and its followers will see it. Then the followers will reply or re-tweet and a second group of people will see this interaction, but after this second step the interaction drops off (Zhang, Mimi, Jansen, Bernard J., Chowdhury, Abdur 2011). When looking at types of interactions with brands, the study Shin, Pang and Kim (2015) found that most interactions were one way rather than two way communication. This does not mean these interactions and the efforts behind them are a waste. It was noted in Shin, Pang and Kim (2015) that when the social media interactions were integrated into broader communications efforts, the effects were amplified. This study also made the attempt of messaging across platforms of communication and mentions more sophisticated methods for this should be developed. The methodology of Shin, Pang and Kim (2015) will serve as a guide when attempting to compare Basketball players to Astronauts.

According to the literature and the Mycelium model of communication there appear to be four underlying interpersonal communication networks that then manifest their effects on the online world of Twitter. The first two groups belong to the subjects and their organizational support structure. The Astronauts and NBA players both must uphold a positive image of themselves and their respective organization. This forms the basis for the rules they must follow on the online and public world. Given these needs the organizations and subjects relationships are influenced and thus influence their communication. The other two groups are the subjects' audiences. Their desires for the type of communication content they want from the Astronauts and the NBA players is influenced by their connections they have to science and the sports communities in the off and online space. This then places demands on the subjects for particular content, otherwise followership will not accumulate and social media interactions will not take place. Understanding the manifestation of the Mycelium forces

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at work in these organizations and audiences will aide in the analysis of the data from the subjects' Twitter feeds (Moquail and Windahl 2013).

Questions

RQ1: How successful are astronauts at engaging audiences on twitter in comparison to NBA stars?

RQ2: How often do astronauts and NBA starts tweet?

RQ3: What kind of tweet post elicit more popularity, considering pathos, logos or ethos?

Methodology

The analysis of the Astronauts and Basketball athletes will be performed by three separate metric break downs of their twitter feed

The first analysis is a comparison of the raw twitter metrics of the NBA Players James Harden (@JHarden 13) and Ty Lawson (@TyLawson3) who will be compared to the Expedition 45 crew members Scott Kelly's and Kejall Lindgren's Twitter activity. Kelly's followership and Linggren's are close to having an equivalent difference in size to Harden 's and Lawson's followership. In this portion of the analysis, there will be no ratio formulated for the difference in popularity of the two communicator groups. The 2014-15 basketball season and finals closely coincide with the Expedition 45's stay on the International Space Station. Astronaut Scott Kelly (@StationCDRKelly) spent nearly a year in space starting on 3/27/15 to 3/2/16. Kejall Lindgren (@astro_kjell) arrived on the station in 7/22/15 and quickly became active on Twitter as well. The NBA Players' time frame is the 2014-15 season which lasted from 10/28/14 - 05/27/15. This team and time frame were chosen due to the

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Houston Rockets and the Astronaut corps belonging to the same community in Houston, Texas and the significance of the Year in Space mission as well as the performance of the Houston Rockets in the 2014-15 season.

The site Twitonomy is an analytics service web site that allows users to look extensively at their personal Twitter accounts and into other user's analytics as well. It was selected since the analytics data of Karen Nyberg on the web site Twitonomy matches closely to data NASA has. Therefore, this will be considered a credible source for the analytics information gathered in this study. The analytics will give information on how prolific, popular, and engaged each subject is with the Twitter community at large.

The coding units for the analytics are: Subject- these are the individuals who are Rockets players and astronauts; Twitter Followers- these are the people who select to keep track of another individual's tweets; Tweets per day- the average number of tweets sent from the subject over a given time period; User Mentions- average number of mentions per tweet, the higher the number the more active the subject; Links- the average number of links per tweet, the higher this coding unit the more likely the subject is a source of information; Tweets Re-tweeted- proportion of the subjects tweets re-tweeted by others, the higher this figure the more the subject is considered a valuable source of information; Tweets Favorited – the proportion of the users' favorited tweets from the subject. Both re-tweets and favorited tweets also measure the average number of favorites by other users. Re-tweets- percentage of re-tweets of the total analyzed tweets by the subject; Replies- the percentage of replies of the total analyzed tweets by the subject; Hashtags- the average number of hashtags per tweet, the higher this figure the more likely the subject's tweets can be found in a search.

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All of these coding units have other sub coding units that pertain to the percentages of the primary coding units total real numbers. Follower/following- the ratio of followers per person followed. A high ratio combined with a large follower base is a good sign that this user is influential. Listed/1,000 followers- Average number of people who added this user to a public list (per 1,000 followers). A high number combined to a large follower base means that this user's tweets are considered relevant to others. Both follower/following and list (per1,000 followers) are metrics that have current information which will be determined at the time of the test, not data from other timeframes. The term event will be used to refer to a moment of significance for each subject. For the astronauts, it is their time in space. For the Rockets players, it will be 2014-15 season.

The next step is to look at the body of both NBA stars that have a followership that are equal to or greater than James Harden on twitter. The same will be done for Astronaut Scott Kelly. Then an average followership of popular NBA players and Astronauts will be calculated. The NBA listing of top followers on Twitter has several players who have very high number of followers and will not be used to find an average star player since most notable NBA players have between 8 to 3 million followers not 31 million. Those players with 30 million followers or more also are not regional stars but national figures. This would undermine the scope of the analysis considering both the Houston Rockets and the Astronauts are from the city of Houston, Texas. The web page fanpagelist.com was used to find the NBA player followership and jsc.nasa.gov/Bios/astrobio.html for the current Astronaut list and Twitter handles.

The ratio of NBA followers to Astronaut followers, which is calculated after rounding to the nearest 100,000 followers for the astronauts and nearest million followers for the NBA players is 25 to 1 NBA players to Astronauts. This ratio is the average difference in followers among the top active

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players and astronauts (F-2.1). This 25 to 1 ratio will be incorporated into the quantitative analysis of the astronauts' metrics when trying to understand how Scott Kelly, Kejell Lindgren, and the Astronaut Corps. As a whole compare to NBA players. A ratio of the whole number metrics between each of the subjects being compared, Scott Kelly to James Harden and Kejall Lindgren to Ty Lawson will also be generated to see how they compare when followership differences are equalized. The coding units which will be used for this subject to subject analysis are Followers, Followers/following, Listed/1,000 followers, Analyzed tweets, Tweets per day, User mentions, Hashtags, Tweets retweeted, Total number of re-tweets, Retweets per retweeted tweet, Tweets favorited, Total number of favorited, and Favorites per favorited tweet. This will also help show where the subjects fall in the 25 to 1 trend of the NBA plays and Astronauts with similar followerships. This will be the mechanism for equalizing the popularity of both communicator groups.

The final portion of the analysis will look at the differences in the tweets' content. Both the top five retweeted and favorited tweets of each subject will be analyzed for language pertaining to logos, pathos or ethos. Appeals to emotion will be considered pathos, appeals to data or reasoning will be logos and appeals to ideals like team work or learning will be ethos. Any images present will be noted as a coding unit and taken into consideration as either context for the words in the tweet or the main subject of the tweet and what effect it might have on the audience. Each of the subjects' tweets will be in a final table of the coding units ethos, pathos and logos will be shown in Figures 3.1-3.16. This portion of the analysis will look the information in the literature review for the reasons why people communicate with the subjects and others that share similar interests (Smith, Smith, Arcand, Smith, Bookbinder and Keach 2011), (Smith and Sanderson 2015), (Smith and Smith 2010).

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All three of these analyses will be looked at for a better understanding of the Twitter communication landscape as it pertains to the study's questions.

Analysis

All of the tables' data are broken down as follows. All of the primary coding units and their corresponding metrics are in yellow. The sub-coding units and their corresponding metrics are in grey blue. The two tables will show the four subjects compared to their counter parts (F-1.1, 1.2). The ratio analysis looks at the top ten NBA players and the top ten Astronauts which give the 25 to 1 figure in followership (F-2.1). The ratio comparison of the subjects' is represented by color in Figures 2.2 (Ty Lawson/ Kejall Lindgren) and 2.3 (James Harden /Scott Kelly) the light green means the ratio is Astronaut to NBA player, light orange means the ratio is NBA player to Astronaut. The final analysis is of the content of each subject's top five retweeted tweets and favorited tweets are Figures 3.1 – 3.16.

Part One Raw Metrics

The first two subjects Astronaut Scott Kelly (@StationCDRKelly) and NBA player James Harden (@JHarden 13) both started using Twitter in Aug. and June of 2009. With James Harden having a month longer of experience than Astronaut Scott Kelly, they both had considerable lead time before the event measurement time frame. With 12,612 life time tweets to 2,426 life time tweets James Harden has considerably more usage experience than Astronaut Scott Kelly. In the metrics of reach James Harden has over double the number of Followers as Scott Kelly. The ratio of Followers to Following James Harden is only higher by 4,000 or one third. This means both subjects are widely seen as influential. Scott Kelly is to be considered more relevant to his audience than James Harden is since

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the Listed/1,000Followers metric is double James Harden 's. However, with Scott's lower overall followership this metric is slightly less significant than if they were equal in followership.

When looking at the first two subjects' use of Twitter the data shows that Scott Kelly is considerably more prolific during his measurement time frame. James Harden had 54 analyzed tweets from 10/28/2014 to 05/27/2015 thus tweeting the equivalent of .25 tweets per day. In contrast Scott Kelly had 1,423 analyzed tweets. The time frame of Scott Kelly was nearly double that of James Harden; however, given this large difference in the number of tweets the difference of time is less of a factor. Both subjects retweeted others tweets very rarely. The metrics looking at how prolific the subjects are clearly show that Scott Kelly during the time frame of the events is far more prolific than James Harden.

Both subjects have an engaged audience with James Harden's data showing that 89%of his tweets are retweeted and 89% of his tweets being favorited. His ratios of the metrics concerned with audience engagement are much lower than Scott Kelly's. James Harden shows 0.33 Retweets/100 Followers in comparison to Scott Kelly's 167. Finally, James Harden links to other information more than Scott Kelly. User Mentions also show Scott Kelly being talked about more by others in their communication. In every metric Scott Kelly is show to have a more engaged audience by at least one order of magnitude except percentage of tweets being retweeted as seen in Figure 1.2.

When comparing the metrics of Kejall Lindgren (@astro_kjell) Ty Lawson (@TyLawson3) in Figure 1.1 the reach of Ty Lawson is higher than Kejall Lindgren's except for Listed/1,000 Followers. Kejall Lindgren had 18 listed/ 1,000 Followers to Ty Lawson's 6. However, with Kejall's lower overall followership this metric is less significant. The two subjects are nearly equal in how prolifically they use

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Twitter. Ty Lawson has 15 more tweets in the event time frame than Kejall Lindren. Other minor inequalities can likely be contributed to by the longer time frame of Ty Lawson's event and therefore conclude that the subjects are either as equally prolific or Kejall Lindren is slightly more prolific.

In the area of audience engagement the subjects Tweets retweeted is nearly identical where Kejall has only a 10% greater number if his tweets being retweeted. In the other metrics of engagement Kejall show a much higher level of audience engagement than Ty Lawson. Both the total numbers of favorites and retweets are higher by two orders of magnitude and the ratios of retweets/ 100 followers and favorites/ 100 followers show Kejall with a much higher ratio of 135 to 1 and 265 to 1 in both metrics. Ty Lawson in comparison has only 3 to 1 retweets/ 100 followers and 5 to 1 favorites/ 100 follower.

Both sets of subjects show what previous research has shown that while earth bound communicators and NBA players have greater reach the astronauts are at least as prolific if not more and have a far more engaged audience (Clark 2014).

Part Two Ratio Comparison

Both Astronaut subjects have a considerably more favorable followership ratio than the average 25 to 1. For Ty Lawson and Kejall Lindgren the ratio of followers is 7 to 1 as seen in Figure 2.2. James Harden and Scott Kelly's ratio is 2.4 to 1 in Figure 2.3. In the ratio comparison of Ty Lawson to Kejall Lindgren the data supports the raw metrics findings as well. The subjects are nearly even in their use of Twitter with Kejall being on the higher end of the ratio. The data on engagement and reach also reflect the raw numbers of Figure 2.1.

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The same is true for the data of James Harden and Scott Kelly the ratio metrics of Figure 3.1 match the raw metrics of Figure 2.1. It is clear that Scott Kelly has a much closer ratio of followers compared to James Harden than the NBA Player and Astronaut average. The ratio of followers for James and Scott is 2.4 to 1 rather than the 25 to 1. In the metrics of reach Scott Kelly only has better numbers on the Listed/1,000 Followers. For the rest of the reach metrics James Harden has a greater reach. When looking at how prolific the subjects are and how engaged the audience is it is clear that Scott Kelly both is more prolific in his use than James Harden and has a more engaged audience by far with the closest ratio being retweets per retweeted tweet at 7 to 1 and the highest difference in total number of favorites at 212 to 1. These ratios help show the orders of magnitude that the subjects have in comparison to their counter parts in each metric category of reach, use and engagement.

Part Three Content Analysis

When looking at all of the top five retweeted tweets and favorited tweets it is clear that emotional appeals through pathos is the most used coding unit (F-4.1-4.4). Every tweet from all of the subjects in the two categories of tweets used pathos. Pathos was used by the NBA players to show their skill, desires for victory and particularly by James Harden to promote products using his personal brand. Vicarious achievement was used extensively by Ty Lawson during a reunion college game against his old rivals. This messaging was use in all but one of his tweets. The Astronauts used the pathos coding unit to show the beauty of Earth and the cosmos. They also use the vicarious achievement effects in their display of the growth of the first flower in space and Scott Kelly in his return home. Ethos was second being used 16 times. The NBA players used ethos 9 times in comparison to the Astronauts 7 times. The times the NBA players used ethos was to show solidarity with the team, fans, or Stuart Scott a sports reporter who passed away during the time frame. The

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Astronauts used it to show solidarity with people on Earth, mark the accomplishments of the mission and to make a comment about the ecological philosophy and cosmic perspective that typically come from seeing the Earth from afar. Scott Kelly also use the ethos to warn people of a hurricane which hit Mexico and show solidarity with the people of Mexico (F-4.4). The logos coding unit was only used by the astronauts and it was only employed a few times. Mainly to share specific information about a place like Mecca and Medina, or specific information about an aspect of space travel (F-4.4).

The NBA Players top retweeted tweets and Favorited tweets were nearly identical. With each of them having only one tweet in the favorited tweets that was different from the retweeted tweets. The Astronauts had a larger difference between the two. Scott Kelly had two different favorited tweets and they were of him retuning home and an emotional appeal for the beauty of the Earth (F-4.4). His retweeted tweets that were not the most favorited were the ones of the hurricane. Kejall Lindgren's differences in the two categories all presented the beauty and fragility of the Earth. The sample size is too small to determine if there is a correlation between Kejall Lindgren's two categories and his use of Gifs. Use of Gifs was something Kejall Lindgren reported preferring to still images. Only three of the tweets did not have some form of other visual media. These three tweets were all from the NBA Players and all but one had links to other social media platforms which did show images or had a link to some other form of visual content (F-4.1, 4.3). The one tweet that didn't have any extra information visual or otherwise appeared to be an argument between James Harden and others, but the context of one tweet cannot determine whether it was part of a larger discussion.

The content analysis reveals at its core the messages the subjects were all sending had different purposes yet fell into similar communication framing in pathos and secondarily ethos. The limited use

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of logos was only to communicate very limited factual information and the rest of the framing of the message used one or more of the other coding units as well (F-4.1, 4.4).

Conclusion

After the examination of the data it can be surmised that the Web 2.0 Mycelium model works. This despite the fact that the method of equalization presupposes that the increase in followership will have a corresponding increase in the other coding units. This is the greatest weakness of this analysis method.

Over all the information which was garnered from the data gave sufficient insight that this and other minor weakness of this study did not have an adverse effect on the conclusions drawn based on the evidence. This is shown by the fact that the raw data and ratio data (F-2.1 and 3.2) show the same information of the three categories: Reach, Use and Engagement.

The content analysis was the most revealing portion of the examination. It showed the clear needs of both the subjects and their audience were being addressed. It also revealed the means by which the subjects appealed to their respective audiences. For the NBA Players there was clear need to promote both the personal brand in the case of James Harden and the team brand in both players' cases. The analytics show the effects of this kind of communication. The NBA Players cast a wide net with far larger followerships than the astronauts on average and in comparison to the two astronaut subjects. The NBA Players don't concern themselves with forming multiple network ties as shown by their engagement metrics. The reason for this is shown by the research Zhang, Mimi, Jansen, Bernard J., Chowdhury and Abdur (2011) and Smith and Sanderson (2015) that players need only interact with their audience one way and have a need for a larger audience to promote themselves in a content

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maker to content viewer method. Only later does the audience interact with its own members by feeding off of the NBA Players messages. This accounts for the findings of high reach, lower prolific use and mid-range engagement as well as the content of their messages as calls to the team, the team's community solidarity or skill at the game. This data fits with the Web 2.0 Mycelium model when examined with the needs of the NBA Players content. Further examination of the subject's followers to would reveal if they are interacting in the way Zhang, Mimi, Jansen, Bernard, Chowdhury and Abdur (2011) and Smith and Sanderson J. (2015) say they should would help to confirm these findings. If this could be achieved the network of interpersonal communication via Twitter could be shown to further uphold the Web 2.0 Mycelium model.

For now, other research on why people follow sports figures and how these fans interact show that indeed the Web 2.0 Mycelium model does work when trying to understand why NBA Players' data follows a primarily pathos driven content. Their messages contain vicarious achievement and lower audience engagement with a high reach. This trend continues with the Astronaut subjects. Both have higher followerships than other astronauts and thus have a better followership ratio than shown in Figure 2.1. Scott Kelly was also well prepared for his year in space and Kjell Lindgren has gotten to see many astronauts use social media before his flight. These two have capitalized on this preparation, previous experience of their colleagues and the notoriety of the year in space mission to have a reach that is higher than average. They still have a smaller reach than their NBA counter parts. However, they are more prolific during the time in space when people will be paying attention. They also have a much higher degree of audience engagement with their content. People who follow the Astronauts consider them to be more of a valuable source of content and share their content much more. The content analysis shows that pathos is the main method of framing their messages as well. The Astronauts did

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use ethos to a slightly lesser degree and use logos far more than the NBA Players to impart small pieces of specific information about the images they were tweeting. The emotional appeals were also of solidarity but not with any given team but with the planet Earth and its people.

Again the Web 2.0 Mycelium model holds up given the forces and needs acting on the Astronauts. The research by Kay (1994) and Bastos, Mercea and Charpenter (2015) show that NASA needs continuous support to undertake long term missions and that political moments are also given traction through the long range interpersonal communication tools of social media. The Astronauts and their audience by the nature of their needs must be more engaged to form any kind of base of support. The Astronauts never ask for it explicitly. Instead they show the value of their work through the vicarious achievements they share with their audience while in space and showing the awe inspiring imagery which holds peoples focuses as shown in Smith, Smith, Arcand, Smith, Bookbinder and Keach (2011). This picture of needs and opinions being met in common networks is precisely what the Web 2.0 Mycelium model predicted. Hard evidence exists in Scott Kelly's tweets of Hurricane Patricia and the fact that it was the most retweeted tweet. The audience interacted with his call for solidarity in similar fashion to political movements. This shows the network's needs. Kejall Lindren also shows how the achievements of space flight evoke awe and a desire to be there with the content creator further showing in an interpersonal network as would be expected from a Web 2.0 Mycelium model. The Web 2.0 Mycelium model also states that subject matters will not be blurred together as content manifests. There are no space tweets from the Houston Rocket subjects and no popular sports tweets from the Astronauts. While there is crossover of sports into space such as Mike Hopkins "Train Like an Astronaut Campaign" and the image of Edwin Hubble's Basketball he played with in college on the final Hubble servicing mission. These instances are anomalies given the lack of crossover content in the data and

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the purely space and sports content shows the networks remain overwhelmingly separate. The Web 2.0 Mycelium model reflects the findings by showing that networks of similar interests and needs will manifest content exclusive to those needs. This is what is shown by the data of this study and the context of other studies.

The Web 2.0 Mycelium model will need future study to show its reliability and validity as a model for social media communication networks. This study was only the first step in testing this new model's ability to show how and why different subjects who belong to different organizations with similar structures content is the way it is. As so far as the data of this research shows it is because of the differing needs of the interpersonal networks of which the subjects are opinion leaders.

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Figures

Figure- 2.1

Ty Lawson and Kejal Lindgren raw metrics

Subjects Metrics	NBA Subject Ty Lawson	Astro Subject Kejell Lindgren
Followers	458200	63790
Followers/following	821	619
Listed/1,000 followers	5.87	18.12
Analyzed tweets	232	217
Analyzed from	28/10/2014	22/07/2015
Analyzed to	27/05/2015	11/12/2015
Tweets per day	1.09	1.52
Retweets	26	9
% of tweets being retweets	11.21	4.15
User mentions	99	50
Mentions per tweet	0.43	0.23
Replies	33	1
% of tweets being replies	14.22	0.46
Links	70	12
Links per tweet	0.3	0.06
Hashtags	121	117
Hashtags per tweet	0.52	0.54
Tweets retweeted	197	208
% of tweets being retweeted	84.91	95.85
Total number of retweets	14346	86596
Retweets per retweeted tweet	72.82	416.33
Retweets/100 followers	3.13	135.75
Tweets favorited	202	208
% of tweets being favorited	87.07	95.85
Total number of favorites	23436	169504
Favorites per favorited tweet	116.02	814.92
Favorites/100 followers	5.11	265.72

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James Harden and Scott Kelly metrics

Subjects Metrics	NBA Subject	Astro Subject
Followers	3570369	1440289
Followers/following	14692	10002
Listed/1,000 followers	2.25	5.55
Analyzed tweets	54	1423
Analyzed from	28/10/2014	27/03/2015
Analyzed to	27/05/2015	02/03/2016
Tweets per day	0.25	4.16
Retweets	6	36
% of tweets being retweets	11.11	2.53
User mentions	29	729
Mentions per tweet	0.54	0.51
Replies	1	51
% of tweets being replies	1.85	3.58
Links	42	254
Links per tweet	0.78	0.18
Hashtags	53	2876
Hashtags per tweet	0.98	2.02
Tweets retweeted	48	1387
% of tweets being retweeted	88.89	97.47
Total number of retweets	11645	2401542
Retweets per retweeted tweet	242.6	1731.47
Retweets/100 followers	0.33	166.74
Tweets favorited	48	1387
% of tweets being favorited	88.89	97.47
Total number of favorites	23194	4920749
Favorites per favorited tweet	483.21	3547.76
Favorites/100 followers	0.65	341.65

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Figure-3.1 Top ten NBA Players and Astronauts on Twitter ratio

Top Ten Astronauts	Astro Followers	Top Ten NBA Stars	NBA Followers
Astro Reid (Reid Wiseman)	476,000	(Carmelo Anthony)	8,027,100
Astro Virts (Terry Virts)	249,000	(Dwight Howard)	6,443,759
Astro KarenN (Karen Nyberg)	195,000	(StephenCurry30)	6,144,585
Astro Wheels (Doug Wheelock)	139,000	(Dwyane Wade)	5,631,900
Astro Tim (Tim Kopra)	113,000	(Chris Paul)	5,172,580
Astro Jeff (Jeff Williams)	79,600	(Lamar Odom)	4,292,967
Astrollini (Mike Hopkins)	66,900	(Paul Pierce)	3,924,052
Astrp Kjell (Kjell Lindgren)	63,900	(Blake Griffin)	3,837,969
astro aggie (Mike Fossum)	55,500	(Pau Gasol)	3,584,653
AstroBehnken (Bob Behnken)	46,300	(Manu Ginobili)	3,522,810
Average	148,420		5,058,238
	200,000		5,000,000
Ratio	25 to 1		

Figure-3.2

Ratio Metrics

Ty Lawson & Kajell Lindgren Ratio

Followers	7.18294403511522:1
Followers/following	1.32633279483037:1
Listed/1,000 followers	3.08688245315162:1
Analyzed tweets	0.935344827586207:1
Tweets per day	0.717105263157895:1
Retweets	0.346153846153846:1
User mentions	0.505050505050505:1
Links	5.83333333333333:1
Hashtags	0.966942148760331:1
Tweets retweeted	1.05583756345178:1
Total number of retweets	6.03624703750174:1
Retweets per retweeted tweet	5.71724800878879:1
Tweets favorited	1.02970297029703:1
Total number of favorites	7.2326335552142:1
Favorites per favorited tweet	7.02396138596794:1

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James Harden & Scott Kelly Ratio

Followers	2.47892541010867:1
Followers/following	1.46890621875625:1
Listed/1,000 followers	2.46666666666667:1
Analyzed tweets	26.3518518518519:1
Tweets per day	16.64:1
Retweets	6:1
User mentions	25.1379310344828:1
Links	6.04761904761905:1
Hashtags	54.2641509433962:1
Tweets retweeted	28.8958333333333:1
Total number of retweets	206.229454701589:1
Retweets per retweeted tweet	7.13713932399011:1
Tweets favorited	28.8958333333333:1
Total number of favorites	212.156117961542:1
Favorites per favorited tweet	7.34206659630389:1

Content Analysis

Figure-4.1 Ty Lawson Top most retweeted & favorited tweets

Top 5 retweeted tweet	Ethos	Pathos	Logos	Image	Notes
@TyLawson3					
1		1		Y	Noting wishes for victory
2		1		Y	Image showing strength
3		1		Y	Image of diseased reporter Stuart Scott JHarden also tweeted
4	1	1		Y	Another picture to show solidarity with college team

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5		1		N	Dose have a link to website made for college game (rivalry)
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Top 5 Faverited tweet	Ethos	Pathos	Logos	Image	Notes
@TyLawson3					
1		1		Y	Same as #3
2	1	1		Y	Same as #4
3		1		Y	Same as #1
4		1		Y	Same as #2
5	1	1		Y	Showing solidarity with college team & call back to memories

Figure 4.2 Kejall Lindgren top five retweeted and favorite tweets

Top 5 retweeted tweet	Ethos	Pathos	Logos	Image	Notes
@astro_kjell					
1		1		Y	Gif video of atmospheric phenomenon
2		1	1	Y	Image of lighting strike that is meant to be awe inspiring
3		1		Y	Gif video of Aurora with reference to beauty

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4	1	1		Y	Image of Earth and appeal to emotion for Earth's frailty
5		1	1	Y	Video gif of aurora and ask for audience participation

Top 5 Favorited tweet	Ethos	Pathos	Logos	Image	Notes
@astro_kjell					
1		1	1		Same as #2
2		1		Y	Same as #1
3		1		Y	Image of sunset representing beauty
4	1	1		Y	Same as #4
5	1	1		Y	Image of Earth and an emotional appeal

Figure 4.3 James Harden top five retweeted and favorited tweets

Top 5 retweeted tweet	Ethos	Pathos	Logos	Image	Notes
@JHarden 13					
1	1	1		Y	image of coach from Nike
2		1		Y	Add of JH holding a HR themed Bank Card

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3		1		N	Seemingly part of an add or argument
4	1	1		N	Tweet is link to JH Instagram post which includes photo
5	1			Y	Image part of outreach event for HR & Nike

Top 5 Faverited tweet @JHarden 13	Ethos	Pathos	Logos	limage	
1		1		Y	Same as #2 from retweets
2	1	1		Y	Same as #1 from retweets
3	1			Y	Same as #5 from retweets
4	1	1		N	Same as #4 from retweets
5		1		N	Link to JH Instagram which includes photo of sports reporter

Figure 4.4 Scott Kelly top five retweeted and favorited tweets

Top 5 retweeted tweet @StationCDRKelly	Ethos	Pathos	Logos	Image	Notes
1	1	1		Y	Image of Hurricane a warning
2		1	1	Y	showing the first flower grown in space

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3		1		Y	Image of Hurricane a warning
4	1	1	1	Y	Photo of holy Islamic cities and a salutation from Scott
5	1	1		Y	Image of Scott looking out of the ISS

Top 5 Faverited tweet	Ethos	Pathos	Logos	Image	Notes
@StationCDRKelly					
1		1	1	Y	Same as #2
2	1	1		Y	Same as #5
3		1		Y	Image of Scott's return home getting off a plan
4		1		Y	Image of Scott's last sun rise
5		1		Y	Image of sunrise