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Carpe Noctem: Social Media and the Sharing of the Night Skies.

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“We are a way for the cosmos to know itself”

– Carl Sagan, from Cosmos: A Personal Voyage, PBS, 1980.

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Table of Contents

Summary **vii**

1. Introduction **1**

1.1 The Hobby that is Amateur Astronomy 1

1.2 A Brief History of Public Outreach in Astronomy 3

1.3 New Media Meets Astronomy 6

2. The Global Question of this Project **8**

3. Literature Research **10**

3.1 Social Media 10

3.1.1 Traditional Media 10

3.1.2 The Internet 12

3.1.2.1 First Rumblings 12
3.1.2.2 The Deluge of the Masses 14
3.1.2.3 The Bursting of the Dam 15
3.1.2.4 The Beginnings of New Currents 18
3.1.2.5 The Carving of New Rivers 20
3.1.2.6 Exploring the New Tributaries 23
3.1.2.6.1 Democratization of the Production Tools 23
3.1.2.6.2 Democratization of the Distribution Tools 24
3.1.2.6.3 Connecting Supply and Demand 25
3.1.2.7 New Ports of Call 26
3.1.2.8 The Ships' Cargo 29
3.1.2.9 The Cost of Upkeep of the New Ports 30

3.1.3 Conclusion 33

3.2 Leisure 33

3.2.1 The Serious Leisure Perspective: A Definition and its Different Types 33

3.2.2 Serious Leisure in Detail 37

3.2.3 Types of Serious Leisure 38
3.2.4 Rewards of Serious Leisure 39
3.3 Motivation Models 40
3.3.1 Humanist Approach 41
3.3.2 Anticipative Approach 42
3.3.3 Behavioural and Neo-Behavioural Approaches 44
3.3.4 Cognitive Dissonance Approach 45
3.3.5 Social-Cognitive Approach 46
3.3.6 Self-Determination Theory 47
3.4 Conclusion 50

4. Theoretical Framework 51

4.1 Social Media and Astrocasting – Bringing the Observatory Home 51
4.1.1 The Meeting Point 52
4.1.2 The Conduct of the Meetings 56
4.1.2.1 The Viewers 56
4.1.2.2 The Astrocasters 57
4.1.3 The Subject of the Meetings 57
4.1.4 Admission Fee = $0.00 58
4.1.5 Ancillary Fees = $0.00 60
4.1.6 Meeting Recap 61
4.2 Astrocasting and the Serious Leisure Perspective 62
4.2.1 What Kind of Leisure Activity is Astrocasting? 62
4.2.2 Distinguishing Qualities for Astrocasting 65
4.2.3 What's in it for Astrocasters? 66
4.2.4 The Serious Leisure Inventory and Measure 67
4.3 Self-Determination Theory of Motivation in Astrocasting. 69
4.3.1 Who Tells Them to do it? 69

4.3.2 Me, You, or Nobody? 71
4.3.3 So, Who is it? 73
4.3.4 The Leisure Motivation Scale (LMS) 74
4.4 The Research Question 75

5. Methodology 77

5.1 A Question of Difficulty 77
5.2 A Question of Seriousness 78
5.3 A Question of Motivation 79
5.4 Operationalization of the research methodology 81
5.4.1 Focus Group 82
5.4.1.1 Recruitment of a Sample Population for the Focus Group 82
5.4.1.2 Conduct of the Focus Group Meetings 83
5.4.2 On-Line Questionnaire 83
5.4.2.1 Recruitment of the Sample Population for the On-Line Questionnaire 83
5.4.2.2 Administration of the On-Line Questionnaire 84

6. Results 86

6.1 Results of the Focus Group 86
6.1.1 Socio-Demographic Data 86
6.1.2 The Beginnings of Astrocasting 86
6.1.2.1 Telescopes 86
6.1.2.2 Mallincam 88
6.1.2.3 Free Internet Streaming 89
6.1.3 The Learning Curve 94
6.1.3.1 Software 96
6.1.3.2 Computer Hardware 97
6.1.3.3 High-Speed Internet Access 98
6.1.3.4 Operation of the Mallincam 98

6.1.4 Discussion 99

6.2 On-Line Questionnaires 100

6.2.1 Socio-Demographic Data 100

6.2.2 Results of the Serious Leisure Inventory and Measure Instrument 103

6.2.3 Results of the Leisure Motivation Scale (LMS) 108

6.2.3.1 Preliminary Analysis 108

6.2.3.2 Results of the LMS and Discussion 111

6.2.4 Discussion 115

7. Conclusion **119**

Bibliography **123**

Appendix A. Recruitment Letter for Volunteers for the Focus Group 135

Appendix B. Consent Form for the Focus Group Volunteers 137

Appendix C. Interview Guide Used for the Focus Group Meetings 141

Appendix D. Recruitment Letter for Volunteers for the On-Line Questionnaire 142

Appendix E. Consent Form for the On-Line Questionnaire Volunteers 144

Appendix F. Socio-Demographic Questions for the On-Line Questionnaire. 147

Appendix G. Serious Leisure Inventory and Measure (SLIM) Questionnaire 148

Appendix H. Leisure Motivation Scale (LMS) 152

Appendix I. Responses to the SLIM Questionnaire and Preliminary Analysis 155

Appendix J. Responses to the Leisure Motivation Scale (LMS) 157

Summary

The emergence of astrocasting on the Internet offered an opportunity to study the creation of a Social Media site, and determine the influence of the participants' perception of this leisure activity and their motivation for it.

The Night Skies Network was examined under a Social Media theoretical framework. The motivation for astrocasting was studied using the Self-Determination Theory of Motivation, and its perception as a leisure activity using the Serious Leisure Perspective.

The methodology used included a focus group that provided a qualitative perspective, and an on-line questionnaire using the Serious Leisure Inventory and Measure and the Leisure Motivation Scale for quantitative data.

The results showed that the Night Skies Network did meet the requirements for a Social Media site, that the participants considered astrocasting as a serious leisure activity, and that they were intrinsically motivated towards it, with a strong emphasis on the Intrinsic Motivation to Know.

1. Introduction

1.1 The Hobby that is Amateur Astronomy

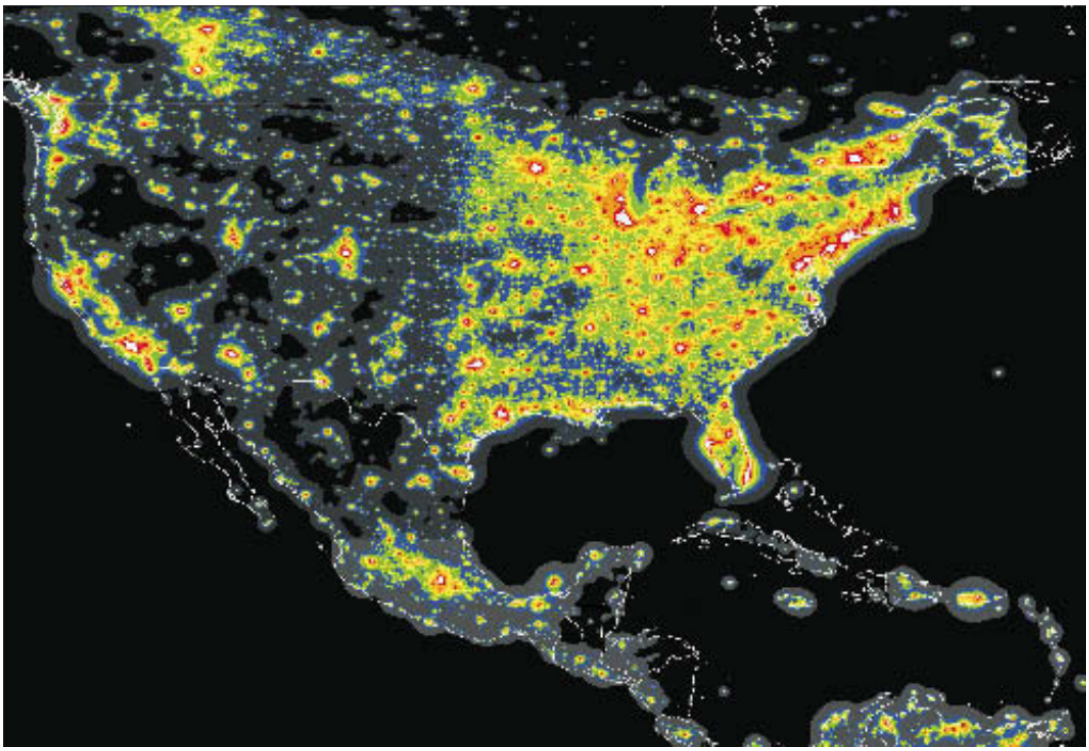
When it comes to hobbies, not many can claim the same august origins as astronomy. People throughout the ages looked at the night sky in amazement, wondering how the stars, planets, the Moon and the Sun all ended up there, and what was our role as a species in the grand cosmic scheme of things.

In a way, the skies are a mirror; the development of astronomy as a science allowed us to test our theories up there. The more we looked, the more we thought, the more we understood both the origins of the Universe and our own place in it.

But that mirror is fading.

With the Industrial revolution came electricity and urbanization. Between 1900 and 1920, the population in the United States, for example, went from mainly rural to mainly urban (U.S. Census Bureau, 1993). Since the first illumination of a town street by electric light in Wabash, Indiana, in 1880, Thomas Edison's invention of the light bulb transformed city lighting to the point that night no longer existed in certain streets, towns, and even whole regions (see Figure 1), with unintended results on humans and animals alike (Rozell, 2009, p. 24). As a result of this scattering of huge amounts of light, the night sky is disappearing from view; where once the Milky Way Galaxy was visible from any place on Earth, only a few stars are now intense enough to pierce this man-made glare in urban environments.

Figure 1. Artificial night sky brightness at sea level for North America (Cinzano, Falchi, & Elvidge, 2001).



For people who want to observe the night skies and share their fascination, a few options are available to them. Amateur astronomers can fight this light trespass by getting involved with like-minded people such as the International Dark Sky Association; they can run away to darker regions, of which there are fewer and fewer; or, they can embrace new technologies that allow them to pierce this haze to reveal, once again, the wonders of the skies.

The year 2009 was declared the International Year of Astronomy by the United Nations (UNESCO, 2007) with the slogan « The Universe, Yours to Discover » (UNESCO and the International Astronomical Union, 2009) to commemorate the first telescopic observations of astronomical objects via telescope (Galileo, 1610). Activities took place to share the night skies with everyone, but not everyone had access to a telescope, or even the night skies. So a

question appears in one's mind: how can the night skies be shared with everyone around the world, irrespective of their location or access to astronomical equipment?

1.2 A Brief History of Public Outreach in Astronomy

The sharing of a passion such as astronomy was severely restricted by physics; amateurs and/or professionals had to be in an appropriate location, most often with a telescope, and have people to share it with. This usually meant that only the really interested members of the public went to observatories to partake in their educational programs and star parties.

Things began to change when John L. Dobson started constructing his telescopes at the Vedanta Monastery in Sacramento back in the late 1950's. Using scrap materials he could scavenge, he started building Newtonian telescopes (light is gathered by a parabolic main mirror and reflected to an eyepiece via a small secondary mirror), grinding away his mirrors by himself. The resulting telescope was then mounted on a simple "alt-azimuth" mount of his own design, basically a rotating platform upon which the telescope was mounted on side bearings, allowing for movement in both altitude and azimuth (Sidewalk Astronomers, 2004). This simple, but effective, combination of the telescope and the mount made for a very inexpensive large-aperture telescope, as seen in Figure 2.

Figure 2. A typical commercial Dobsonian telescope.

After being kicked out of the monastery for being AWOL too often, he founded the San Francisco Sidewalk Astronomers in 1968 to share his passion for astronomy with the public. As the name of the group implies, he began setting up his telescope on a sidewalk corner and invited passers-by to look at various objects in the sky. The movement mushroomed from there.

Today, most astronomy groups hold sidewalk sessions in their regions. For example, the Ottawa Valley Astronomy and Observers Group (OAOG), founded in 1994 (OAOG, 2001), holds monthly sidewalk sessions at Chapters' on Ogilvie Road in Ottawa. Under the glare of

huge parking lot lights, the OAOG shows the public the brighter objects, such as the Moon and the planets.

But what could be shown visually (i.e. at the eyepiece) when they began was only a small fraction of what was in the skies; galaxies, nebulae and star clusters remained elusive targets for urban public astronomy sessions simply because the glare from all the lights all but washed them out. Also, some members of the public could still not appreciate the wonders that were on offer for various reasons, such as a mobility handicap or bad eyesight.

Rock Mallin, one of the founders of OAOG, decided to do something about it. An electronics specialist who owned a local shop, he started working on adapting video systems to telescopes; these systems would then display the acquired images on a TV monitor. People of all walks of life could then view the same object comfortably, at the same time, live.

Video systems are not new to astronomy. The first video recording of an occultation of a star by the Moon was made in 1979 in Japan (International Occultation Timing Association, 2007, p. 20). But these systems were not designed to display live images of deep-sky objects, only bright objects such as the Moon, planets or bright stars.

After 5 years of research, Mallin introduced the Mallincam in late 2002 (Legault, 2002). It was one of the first video cameras that allowed for black-and-white live imaging and displaying of deep-sky objects from a telescope on a TV screen, despite the severe light pollution in Ottawa. He and a few other enthusiasts then began showing up at the OAOG's sidewalk astronomy sessions to show them something beyond the Moon and planets in February 2003; a very successful session held at a local Tim Hortons on the 7th of that month showed

the Great Orion Nebula, catalogued as Messier object #42, which was a great hit with the crowds (Martin, 2003).

This innovation was an instant success, and Mallin then decided to bring his setup to the OAOG's Astronomy Day activities on May 10, 2003. With a GoTo telescope (short for "Go To Object", a robotic telescope that can point at any object in the sky and track it precisely), he used his latest creation to share views of celestial objects not normally seen from an urban parking lot, with an additional twist; he took the video output and hooked it up to a video capture device on his laptop, and provided free printouts of live images to all who requested one. Later that year, the OAOG was rewarded by the Astronomical League with an "Honorable Mention" award for Astronomy Day for providing a "souvenir print out of live CCD sky observing", a world's first (Astronomical League, 2003). This spurred Mallin to continue in this avenue.

1.3 New Media Meets Astronomy

In September 2006, after purchasing the latest version of the colour Mallincam, Jason Davis and a few friends began doing occasional live broadcasts called Cosmocasts on the Internet using a satellite link, commercial software installed on a server, and a few telescopes from a dark site in Utah, at their expense (Astrochannels, 2006). People from all over the world (including Australia and Singapore) logged in to these shows. But, despite the pleas for voluntary donations to help offset the costs of such an endeavour, very little money was collected. Unfortunately, the venture ran out of money, and the last Cosmocast was held in May 2007.

In February 2008, a new service became available on the Internet: « Yahoo! » began offering free live video broadcasting via Internet to the general public, effectively letting anyone create their own private channels. This service, called Yahoo! Live, was not only free for the viewers, but also for the broadcasters. The service was supported by ads displayed on the page. Other services, such as Ustream.tv, Sparkcast.tv, and Justin.tv, have appeared since.

As soon as he got wind of this new possibility, Mallin decided to try to combine it with the views obtained from the Mallincam, and he broadcast the partial lunar eclipse of February 20, 2008 from his home in Ottawa. To his great astonishment, a viewership of over 60 people from around the world joined in to observe this celestial event, and they interacted with him in an adjoining chat window (Mallin, 2008). This new phenomenon was later given the name “astrocasting” (Boyle, 2008), which is a portmanteau of the words “astronomy” and “broadcasting”.

At this point, Lars Zielke, of Tvis in Denmark set up a page called SkyChannels that regrouped all live astronomy broadcasters on one site, at http://www.skychannels.org, but it was abandoned soon after Yahoo! pulled the plug on Yahoo! Live on December 3, 2008 (Short, 2008).

The same concept was again picked up by Jim Turner, an amateur astronomer from North Carolina, USA. After purchasing the required software with Mallin, and finding and installing it all on a hosted server, the Web site “Night Skies Network” (http://www.nightskiesnetwork.com) went online on January 1, 2010 (Mallin, 2010).

2. *The Global Question of this Project*

For this research, the following definition of astrocasting will be used:

Definition 1

> *The sharing on a dedicated Social Media Web site of live astronomical observing sessions using the video feed produced by a Mallincam attached to a telescope.*

Many complex tasks must be done and many conditions met in order to attempt an astrocasting session: setting up a traditional telescope, feeding a video signal of live observations to a computer, and sharing the observations live with others on the Internet. It is therefore not surprising that an electronics expert and long-time amateur astronomer like Mallin should be the first to succeed.

For any other amateur astronomer to attempt this, one has to be quite knowledgeable about astronomy and its related equipment, since there is a steep learning curve involved for the video camera itself. If the availability of the night sky is added to this list of obstacles (the weather, light pollution, an observing station with both power and Internet connections), one would be hardly surprised if no one else tried his or her hand at astrocasting.

Yet, many people do. As of August 2011, 301 channels have been created on the Night Skies Network (Turner, 2011), and a few minutes of browsing reveals that people from around the world have set up a channel from their observing site. Since there are channels located worldwide, and all of them can be surveyed from the main page to find one that is

webcasting at any given moment, the chances are good that someone somewhere is astro-casting on the Internet.

And therein lies the global question underlying this study: what motivates amateur astronomers to broadcast live on the Internet their astronomical observations made with a Mallincam?

3. *Literature Research*

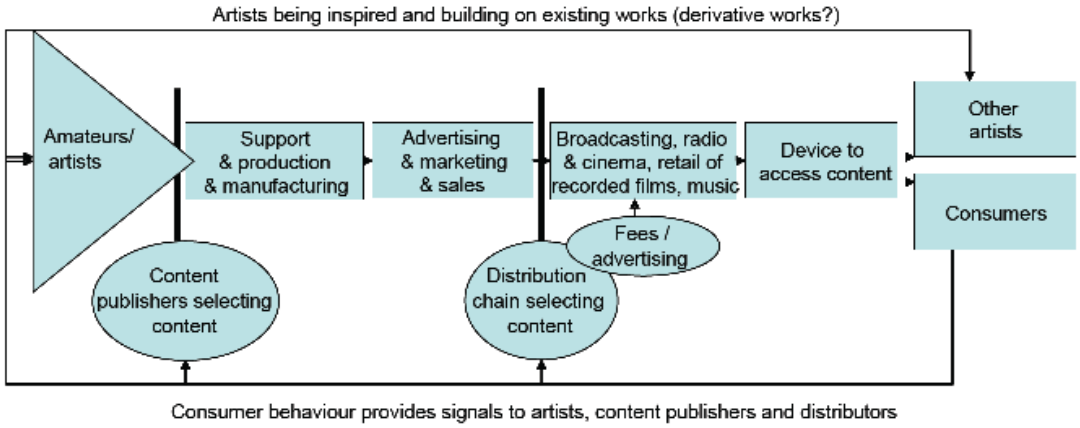
Three fields of research can be derived from the general question above: a) social media, b) leisure (amateur astronomer), and c) psychology (motivation). In order to formulate precisely an object for this research project, all three are explored in the following sections.

3.1 Social Media

3.1.1 Traditional Media

Prior to the start of the first publicly-available dial-up access to the Internet by The World in 1989 (Software Tool & Die, 2006), there were four main media types operating in the world: television, radio, audio/visual (recordings and movies), and print. All four operated with the business model found in Figure 3.

Figure 3. Traditional offline media publishing value chain (OECD, 2007, p. 42).



The major media firms stayed in business thanks to the fees or advertising revenues generated from the dissemination of content, which offset the costs of its production or acquisi-

tion. However, in order to remain profitable, these firms had to listen carefully to the signals provided by the consumers. Therefore, the main gatekeepers of this business model (content publishers and distributors) had to choose carefully for content that would be sufficiently popular with the public for the revenues to outweigh the costs. The result of this feedback cycle was that only the most popular content (as requested by the users and decided by the gatekeepers) would make it to market for the public to consume; the media firms thus generating their profit from economies of scale.

Since content was expensive to produce, acquire, and disseminate, major firms emerged that controlled what was consumed; also, due to the nature of the distribution chains, only limited feedback was available (viewership, sales),[1] and reliable data from consumers for businesses that relied on advertising, such as television and radio, had to be purchased from polling firms, such as The Nielsen Company, which bills itself as "the world's leading marketing and media information company" (The Nielsen Company, 2010).

Word of mouth also played an important part in the creation of the hit. Termed the "water-cooler effect", people would discuss anything interesting they consumed media-wise whenever they met informally (especially around the company water cooler in big businesses), and would either encourage or discourage further consumption of said media depending on their appreciation of it (Grewal, Cline, & Davies, 2003, p. 187).

[1] While writing letters to the editors, producers, or distributors of the content has always been possible for the consumers, the impact of that feedback has traditionally been limited at best, as the media firms kept an eye on profits instead.

The main result of this convoluted feedback loop was the "hit culture", where the successes guided the gatekeepers towards investing in established content providers, be it popular actors for movies and television, authors that make it on the New York Times best-seller list, or singers that have their songs played most often on the radio stations.

But for any firm to remain in business, the cost/benefit ratio of their operations must remain smaller than one (i.e. benefits overweight costs). This restriction imposes limits on what can be produced and sold: shelf space at bookstores and music stores is limited, and radio and television stations – which have their prime-time periods when they disseminate what's most popular – only have 24 hours in a day. Simply put, the selection of media available to the consumer was limited.

The advent of the Internet, as explored in the following sections, was about to turn this world upside-down by giving control to the content creators instead of the traditional gatekeepers.

3.1.2 The Internet

3.1.2.1 First Rumblings

The Internet was born as a project of the Advanced Research Projects Agency of the United States Army to network mainframe computers together in a way that would make it impervious to a nuclear attack. "This network, called the ARPAnet, was built to study techniques to provide robust, reliable, vendor-independent data communications" (Hunt, 2002, p. 2), and was first started in 1969. Other computers from military, research, and educational institutions later joined the network in the 1970's and early 1980's, and in 1985, the National

Science Foundation (NSF) took over the control of the main backbone (56Kbps) and linked five supercomputer centres using the recently-adopted communication standard, TCP/IP (Transmission Control Protocol / Internet Protocol) (Hunt, 2002, p. 3).

On November 12, 1990, with the assistance of Robert Caillau, Tim Berners-Lee sent an e-mail message to his superiors at CERN (European Organization for Nuclear Research) describing a Hypertext project "to link and access information of various kinds as a web of nodes in which the user can browse at will" (Berners-Lee & Caillau, 1990). This would be the birth of the World Wide Web, and the first server to host text-only Web pages (served to all via the HyperText Transfer Protocol, or http) was a NeXT computer installed on Berners-Lee's desk. The first browsers developed to view these pages were also text-based only.

The following breakthrough for the nascent World Wide Web was the arrival of the first graphical browser, NSCA Mosaic, in 1993. Supported by a funding program initiated by the High Performance Computing and Communication Act of 1991, introduced by U.S. Senator Albert Gore, Jr. (Congress, 1991), it was developed at the National Center for Supercomputing Applications (NCSA) and deployed in tandem with further investments in fiber-optic networks in the United States. The ease of navigation that Mosaic permitted allowed the World Wide Web, with its marked-up pages using HyperText Markup Language (HTML), to become the dominant protocol for viewing documents on the Internet.

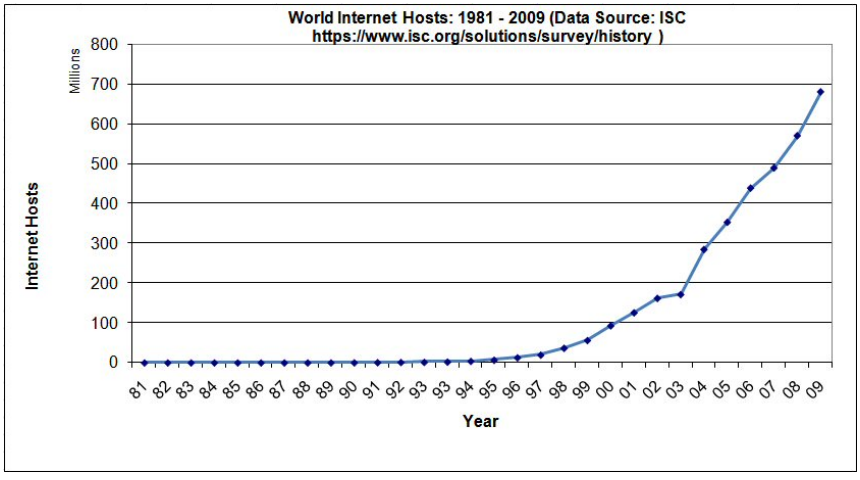
With the release in 1994 of the Netscape Navigator browser, based on NCSA Mosaic, and the maturing of public Internet Service Providers such as America Online, Prodigy, and CompuServe, the conditions were ripening for an incoming public invasion of the Internet.

3.1.2.2 The Deluge of the Masses

On August 24, 1995, Microsoft released Windows 95, a new operating system (OS) based on a graphical-user interface which included a new Web browser, Internet Explorer. The software company also entered the market as an Internet Service Provider (The Microsoft Network, later to become MSN), joining many firms, such as AOL, Prodigy, and CompuServe, that were already doing so. This further commercialization of the Internet pushed the NSF to relinquish control of the main backbone, devoting itself instead to a new backbone for research purposes only called the Internet2 project (Stewart, 2000) (Howe, 2010).

As a result, Internet usage grew rapidly after 1995, as evidenced by the number of Internet domains (or hosts) graphed versus time in Figure 4.

Figure 4. Number of Internet hosts over time (Masters, 2009).



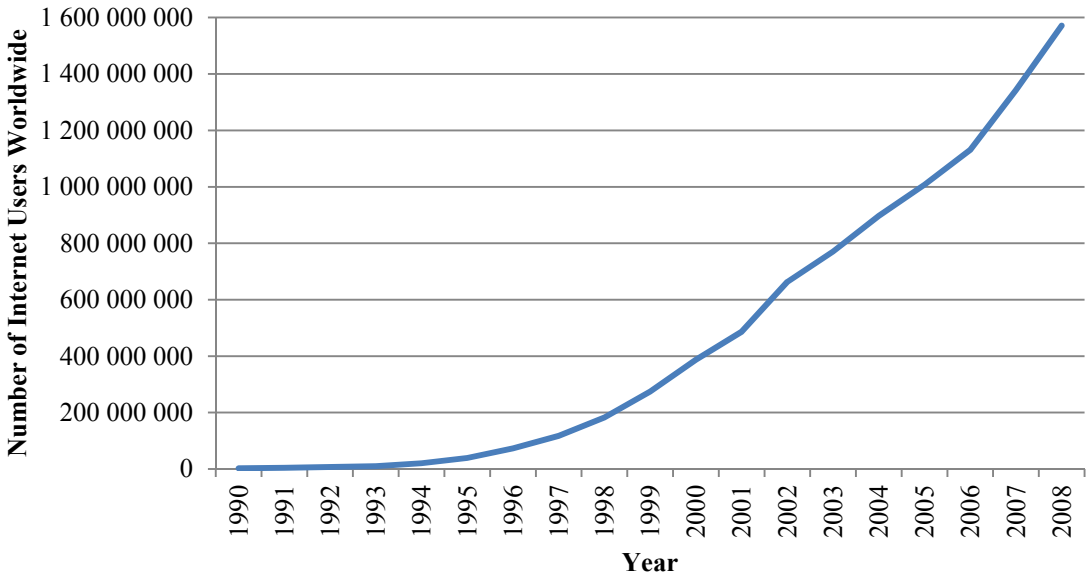
According to the Internet Systems Consortium, the number of hosts went from 5,846,000 in January 1995 to 14,352,000 in January 1996, and the number of registered domain names from 71,000 to 240,000 in the same period (Internet Systems Consortium, 2009).

As more and more people began accessing the Internet many commercial and cultural firms began offering their content on the Web. The Musée du Louvre, for example, registered the domain louvre.fr on July 17, 1995 (Whois.net, 2010), and shortly thereafter began to make its collection, divided into eight themes, accessible to all (Le musée du Louvre, 1995, p. 215). Also, that year eBay started as a Labor Day weekend experiment called AuctionWeb (eBay Inc., 2010), and Amazon.com launched its first Web site (Amazon.com, Inc., 2010).

3.1.2.3 The Bursting of the Dam

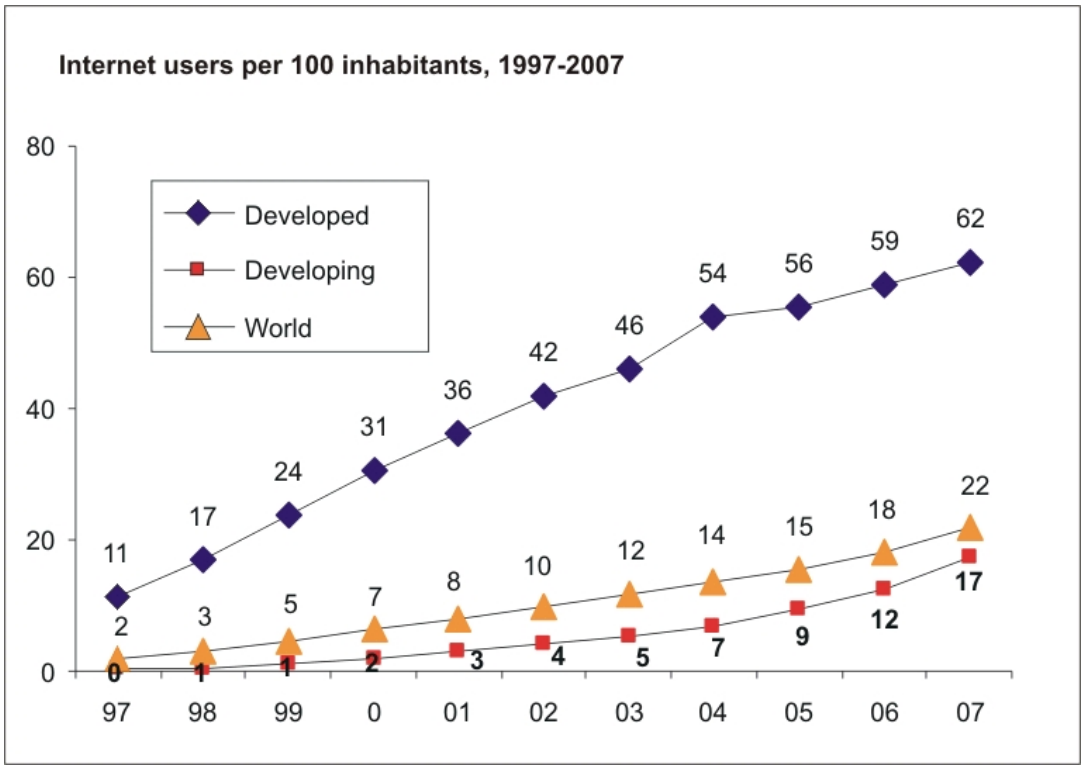
Most of the Web pages at that time did not allow for much interactivity; they were mostly consulted as a person consults a book, where not much discussion with the author was possible. Yet, despite this, the number of Web users grew at an astounding rate, from 39,309,237 users in 1995 to 117,266,824 in 1997; as of 2008, there was an estimated 1,571,129,555 Internet users (The World Bank, 2010, p. 23), which represents 23.5 percent of the world population (U.S. Census Bureau, 2010).

Figure 5. Number of Internet Users Worldwide vs. Time (The World Bank, 2010, p. 23).



The Internet opened a new world of communication to people that included instant messaging, e-mail, and the World Wide Web. However, adoption of the technologies that allowed people to access them grew unevenly throughout the world; this "digital divide" between people who had access to the Internet and those who did not is well illustrated in Figure 6.

Figure 6. Internet user penetration rates worldwide and for developed and developing regions, between 1997 and 2007 (International Telecommunications Union, 2008).



Nevertheless, the worldwide nature of the Internet removed one important barrier to communication and information sharing, that of locality. This "tyranny of locality", as termed by Anderson (Anderson, 2008, p. 17), prevented people from accessing information and products unless it was economically viable to distribute it. For example, movies, music, and books had to be popular enough (or predicted to be sufficiently popular by the gatekeepers) for them to be widely accessible. Also, research in any field was limited to the accessibility of local libraries and the number of documents contained therein.

The Internet, by removing the locality hindrance to people who could access it, changed all that. A poignant example in astronomy of the information available anywhere is the

WorldWide Telescope (http://www.worldwidetelescope.org); as well as re-awakening the interest for science among the population, it aimed "to aggregate scientific data from major telescopes, observatories and institutions and make temporal and multi-spectral studies available through a single cohesive Internet–based portal" (Microsoft Research, 2009). Such ease of access to huge amounts of information (evaluated in terabytes by Microsoft) was unheard of before the Internet came along.

3.1.2.4 The Beginnings of New Currents

The commercial sites that appeared on the Web since 1995 applied the same business practices than those in brick-and-mortar establishments, as they had little else to go on. One metric that was applied for ages was customer satisfaction; an example of such metrics used was the American Customer Satisfaction Index (ACSI), initially developed by a group of researchers at the National Quality Research Center, in cooperation with the American Society for Quality and the Claes Fornell International Group (American Customer Satisfaction Index, 2010). It was inferred that satisfied customers would return to the same establishments for further consumption of product and services.

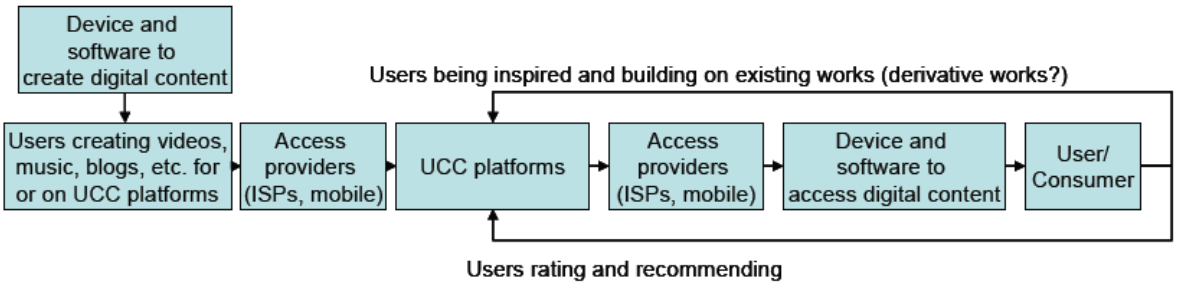
A new index, developed by Gallup Research in the early 21st century, was created to determine the level of customer engagement via their new metric, CE[11], which seeked to measure "rational formulations of (customer) loyalty according to three factors… (and) eight measures of emotional attachment" (Appelbaum, 2001, p. 2). One of the three key loyalty factors measured was the intent to recommend.

Amazon.com, the leading bookseller on the Internet, came up with a feature found on the description page of all the books called "Customers Who Bought This Item Also Bought…" where customers viewing the description of a book saw what other customers also unwittingly recommended with their other purchases. At the bottom of these pages was also included a section called "Customer Reviews", where comments on purchases of the book could be made.

This combination of features led to a revival of a book that was almost out of print. When a book written by Jon Krakauer about a mountain-climbing tragedy called *Into Thin Air* was published in 1996, a second book written in 1988 by Joe Simpson called *Touching the Void* suddenly started selling again, due to the many recommendations received for the second book when commenting on the first one. This would not have occurred it if wasn't for Amazon.com's seemingly infinite shelf space and real-time buying information that the two features mentioned above could provide (Anderson, 2008, p. 15).

This new capability was one of many that ushered in the era of Web 2.0. With the old model (now termed Web 1.0), Web surfers used browsers to look at mostly static Web sites, and little interaction occurred. The added interactive features added on these sites allowed users to contribute to the content of the sites they visited and create their own on their own sites, ushering in a new business model for commerce on the Internet.

Figure 7. Original Internet value chain for user-created content (OECD, 2007, p. 43).

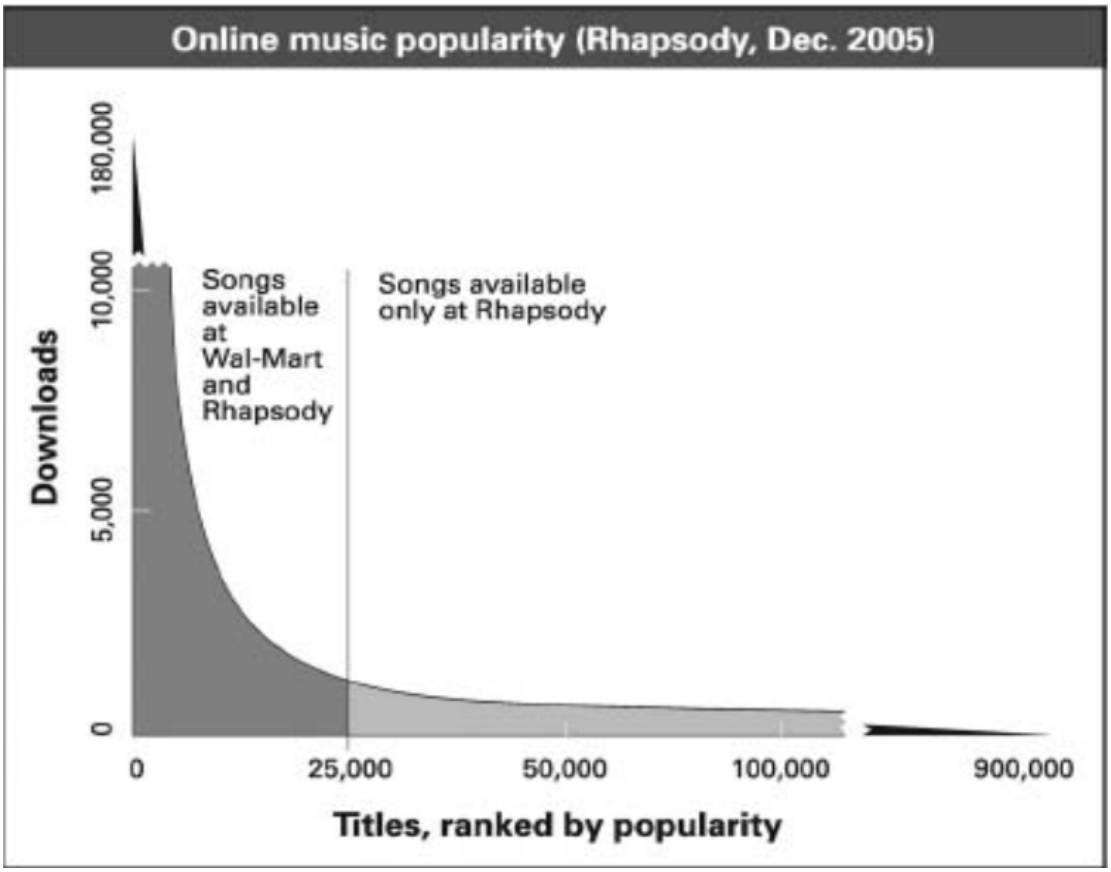


To use the terminology of the traditional model introduced earlier in Figure 3 on page 10, the power of the gatekeeper shifted from owners of big corporations to the everyday user of the Internet. As in the case studied, astrocasting went from an endeavour that only major corporations could afford to one that anyone could attempt.

3.1.2.5 The Carving of New Rivers

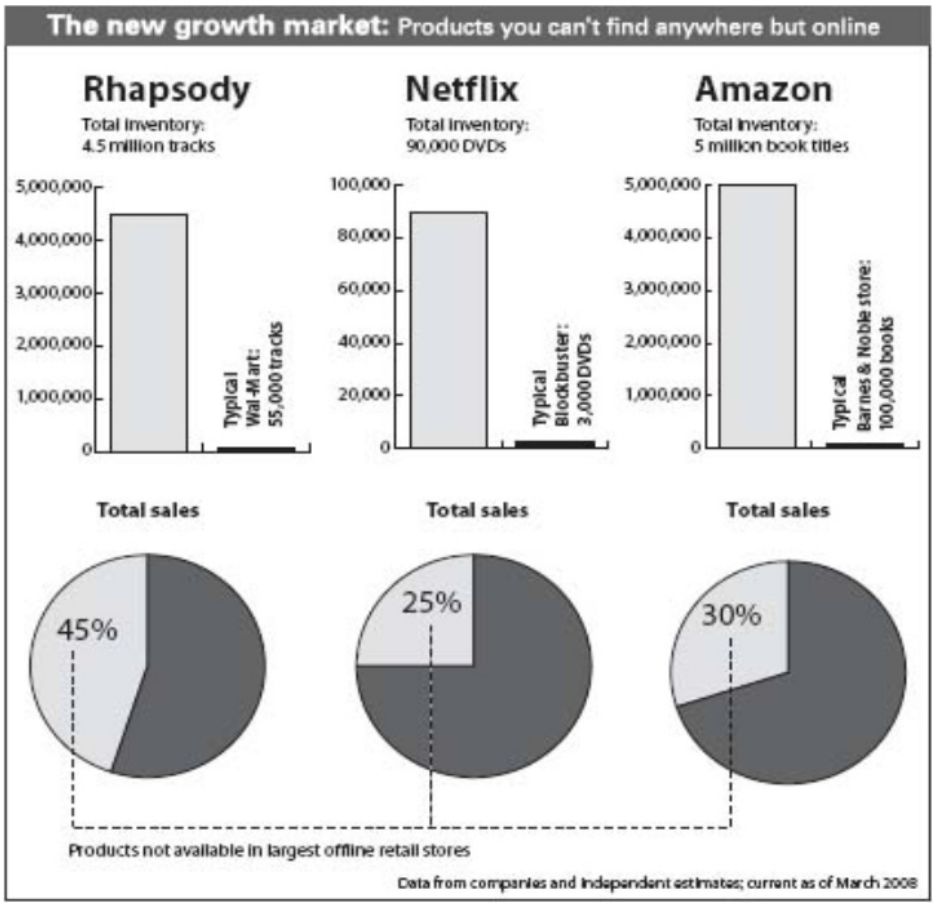
Amazon stumbled upon a business model that Chris Anderson, Chief Editor of Wired Magazine, termed "The Long Tail" in the October 2004 issue (Anderson, 2008, p. 10). The same thing happened at Rhapsody, an on-line retailer where individual music tracks could be purchased and downloaded.

Figure 8. The Long Tail (Anderson, 2008, p. 24).



For big-chain stores like Wal-Mart, shelf space had an intrinsic cost (usually paid in dollars per square foot). This economic limitation in space prevented these retailers from having the entire inventory of music ever produced in stock in all their locations, so they used a cost-benefit analysis to determine how much selection each store would carry, and chose the best-sellers to maximize profit of the selection carried. Figure 9 shows this clearly.

Figure 9. Market availability of products (Anderson, 2008, p. 23).



With the wide adoption of the Internet, for a "virtual retailer" (basically a huge warehouse connected to a Web site) such as Amazon, the geographical limitations that prevented customers from getting their hands on the desired products disappeared. The warehouse could be located anywhere in the world and connected to an efficient delivery system (postal service or courier); therefore products cost less to store, allowing a much wider selection. The end result was a wider selection available to all wherever an Internet connection could be found, thus eliminating what Anderson calls the "tyranny of locality" (Anderson, 2008, p. 17).

Furthermore, if the products were purely digital, as in Rhapsody's case, they could be stored much more cheaply, and delivered instantly, thus eliminating the time from purchase to consumption to nearly nothing. Borrowing Anderson's phraseology, this could be termed the elimination of the "temporal tyranny".

3.1.2.6 Exploring the New Tributaries

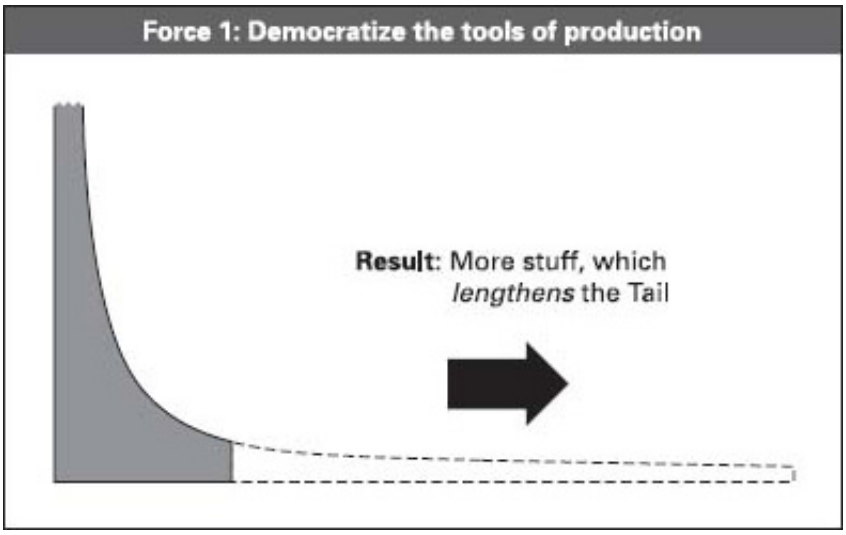
According to Anderson (Anderson, 2008, p. 52), any business that uses the Long Tail business model has to take into account three forces to make it successful.

3.1.2.6.1 Democratization of the Production Tools

By lowering the production cost of the products, more can be made available on the marketplace. The wide scale adoption of the personal computer in the late 20th century put one of the most powerful tools in virtually everyone's hands, since these machines allowed anyone to be a producer of content (be it music, books, or live astrocasting sessions).

The increased variety of products has, as a result, a lengthening effect towards the left for the Long Tail depicted in Figure 10, i.e. the content available on the Web diversified to include everything, including leisure activities such as those related to astronomy.

Figure 10. Democratization of the production tools (Anderson, 2008, p. 54).

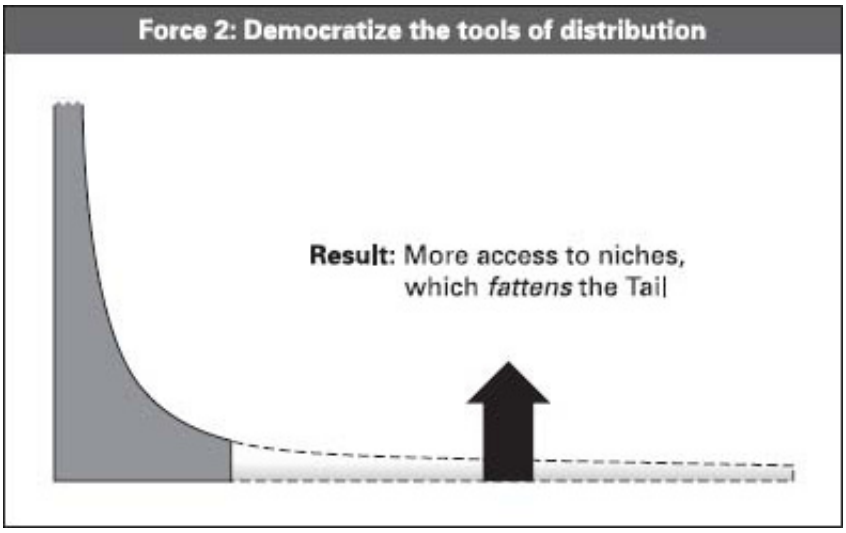


3.1.2.6.2 Democratization of the Distribution Tools

The products have to be stored somewhere so customers can consume it. The lowering cost of media storage has come down dramatically: The "cost per (megabyte) has gone from $200 in 1980 to $20 in 1990 to 2 cents in 2000" (Steege, 2009). In 2010, a hard drive with a terabyte capacity cost about $100, making each megabyte cost *one tenth-thousandth of a cent*.

Combined with dropping Internet usage costs, any digital media can be distributed for virtually nothing. This has the effect of thickening the Long Tail as shown in Figure 11, i.e. more people participating in the new activities found on the web, such as astrocasting.

Figure 11. Democratization of the distribution tools (Anderson, 2008, p. 55).

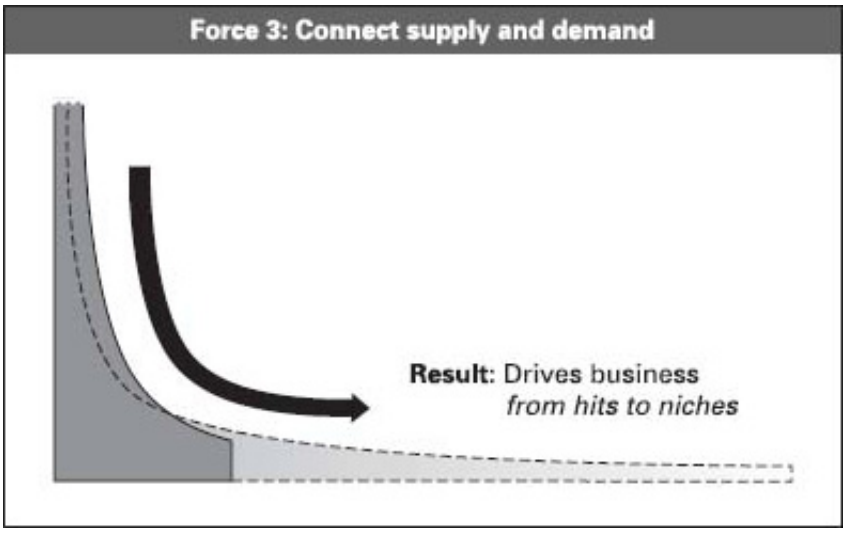


3.1.2.6.3 Connecting Supply and Demand

The sale of little-known products is highly dependent on the ability of potential customers finding it. Efficient ways of searching for these therefore are dependent on search engines, either in-house (Amazon) or external (Google, Yahoo!, Bing). The more efficient the search algorithms, the better chance of users finding that rare pearl they are looking for.

The end result of connecting supply and demand more efficiently is the driving of business from popular hits to the niches that are usually less in demand, *but in demand nonetheless.* And because a small percentage of a large number can still be a large number, offering everything can suddenly become economically profitable (Anderson, 2008). Even small activities such as astrocasting can benefit from the huge referring power of search engines.

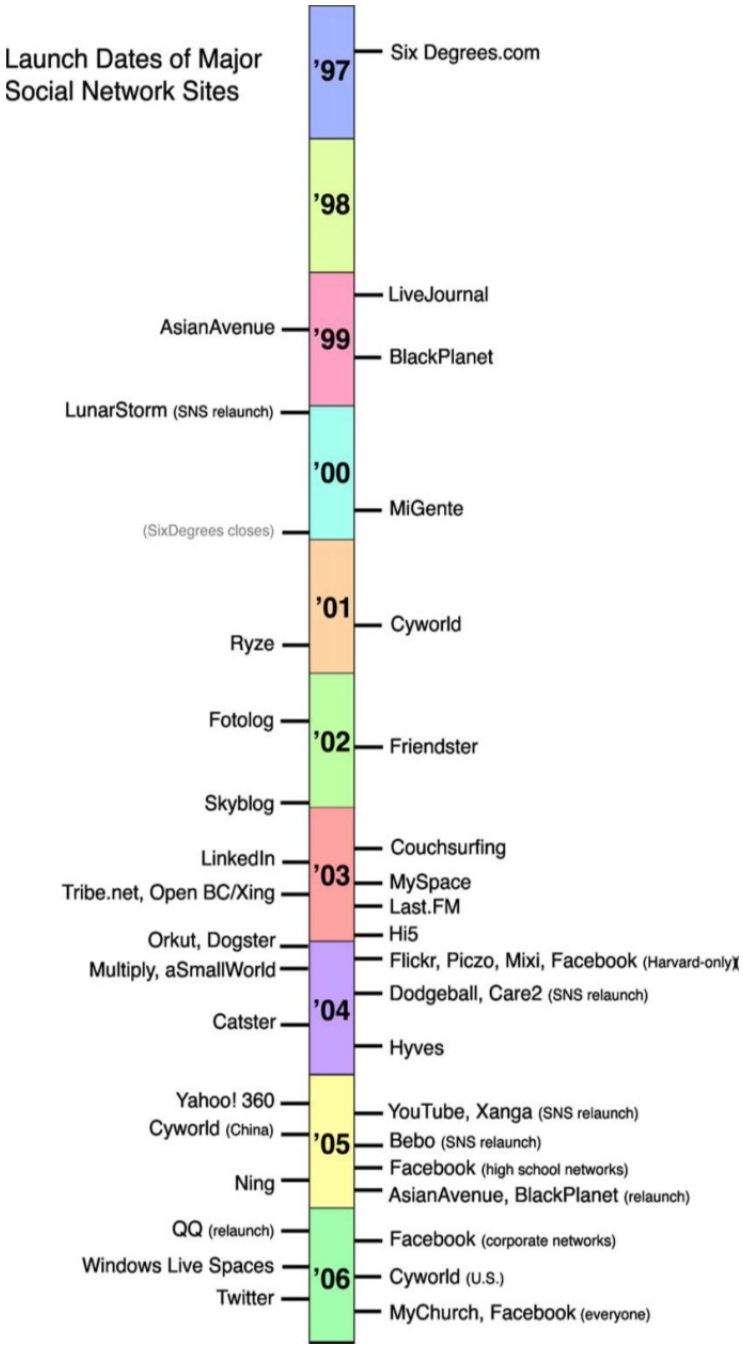
Figure 12. Connecting supply and demand (Anderson, 2008, p. 56).



3.1.2.7 New Ports of Call

The increase in Internet usage has also made possible the creation of meeting sites. As evidenced in Figure 13, the creation of these social networking (or social media) sites accelerated dramatically after 2002.

Figure 13. Timeline of the launch dates of many major Social Media sites and dates when community sites re-launched with Social Media features (boyd [*sic*] & Ellison, 2008, p. 212).



boyd [*sic*] and Ellison defined social networking (or social media) sites as follows:

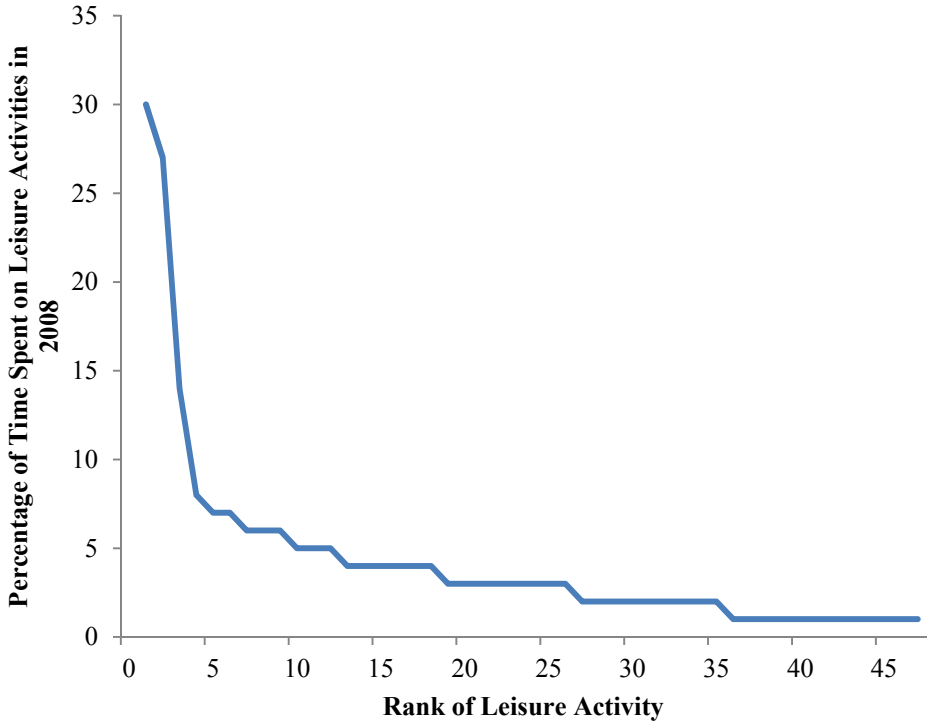
Definition 2

> *"We define social network (or social media) sites as web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system"* (boyd [*sic*] & Ellison, 2008).

The amount of leisure time that Americans spend on computer activities has increased from 2% in 1995 to 9% in 2007 (Harris Interactive Inc., 2008). Also, the time spent on social media sites is used mainly "to maintain existing offline relationships or solidify offline connections, as opposed to meeting new people. These relationships may be weak ties, but typically there is some common offline element among individuals who friend one another, such as a shared class at school" (boyd [*sic*] & Ellison, 2008, p. 221).

The Harris Interactive survey has measured the percentage of leisure time spent on activities, and the resulting curve for 2008 is shown in Figure 14.

Figure 14. Percentage of Time Spent on Leisure Activities in 2008 versus the Rank of Leisure Activity (Harris Interactive Inc., 2008).



The curve in Figure 14 shows a Long Tail distribution of time spent on leisure activities. With near-ubiquitous access to the Internet, very low costs associated with social networks ($0 for the users), and pre-existing social links between those involved, social networks on the Internet based on any leisure activity imaginable can be found.

3.1.2.8 The Ships' Cargo

In the pioneering years of public access to the Internet (1995-1999), people who wanted to create content for others to see (mainly by creating personal Web sites) had to have some programming skills to put up their creations on the Web. With the arrival of enabling technologies that allowed the easy sharing of digital content (i.e. Web 2.0), most users were

freed from the programming pre-requisites, thus simplifying the sharing. As with astro-casting, no programming is required to both the webcaster and the general audience.

The combination of Web 2.0 and user-created content marked the birth of Social Media, defined by Kaplan and Haenlein as follows:

Definition 3

> *"A group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content"* (Kaplan & Haenlein, 2010, p. 61).

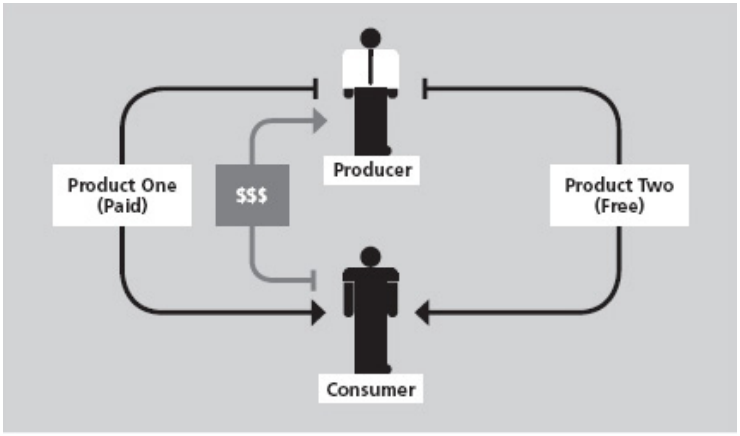
YouTube is a prime example, as it doesn't require any programming skills to share videos on its site. Although most social media sites are free for the users, the enabling technologies and server space for the easy creation and sharing of user-created content come at a cost; the matter of paying for these services therefore becomes primordial, and business models have to adapt to this environment.

3.1.2.9 The Cost of Upkeep of the New Ports

Anderson, in his book "Free: The Future of a Radical Price" (Anderson, 2009, p. 22), outlined four models of operation for businesses that provide a product or service for free.

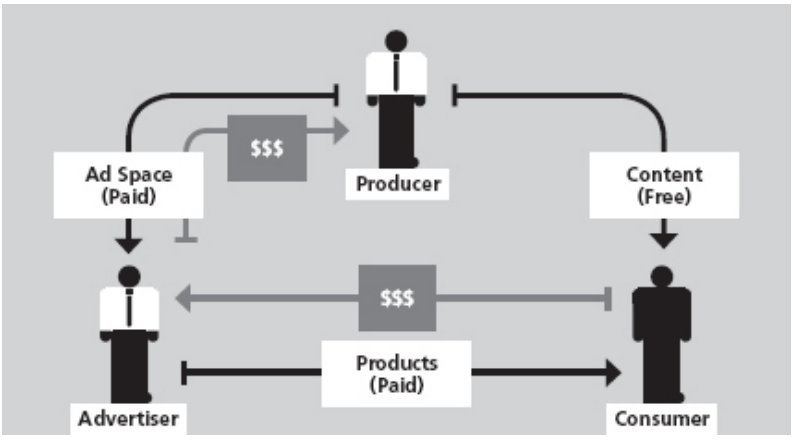
i) **Direct cross-subsidies:** This model is exemplified by the loss-leader system where one product is offered at a loss to entice the user to come and purchase other products or use other services found at the same site.

Figure 15. Direct Cross-Subsidies Model (Anderson, 2009, p. 23).



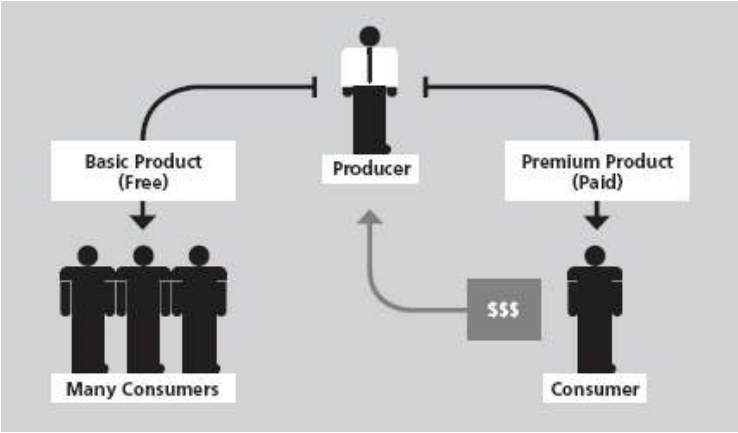
ii) **The Three-Party Market:** A third party pays for the services exchanged between the users and providers. The typical example in this case is free-to-air television, where advertisers pay the networks to promote their products during the airing of programs.

Figure 16. The Three-Party Market Model (Anderson, 2009, p. 25).



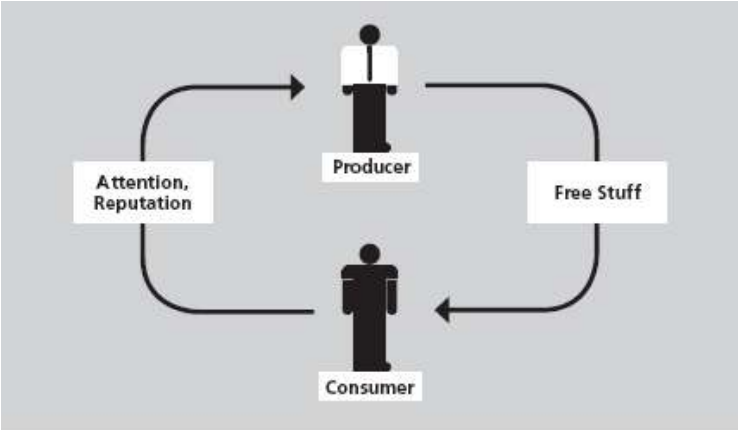
iii) **Freemium:** This model provides free basic products to users, with the possibility of accessing premium paid products for those ready to pay. If some users on a site (usually 5 percent) pay for premium content, the basic content can be provided to all for free.

Figure 17. The Freemium Model (Anderson, 2009, p. 26).



iv) **Nonmonetary Markets:** This model is very similar to the Freemium model, except the service or content is provided for free without any expectation of payment from anyone. This is where someone pays for the expenses out of a sense of altruism to achieve some personal goal or purpose.

Figure 18. The Nonmonetary Market Model (Anderson, 2009, p. 28).



3.1.3 Conclusion

The Social Media landscape is a continuously evolving one, as its historical evolution as previously explored has shown. Therefore, in order to advance the study of astrocasting as an emerging phenomenon, this study will use the concepts herein described as the main framework for further study; the theoretical framework as it applies to astrocasting will be fully delineated in the Theoretical Framework section of this thesis.

3.2 Leisure

As mentioned earlier, social networks are generally formed around a common offline activity for the individuals involved. Since this project aims to study that of a specific application of amateur astronomy, a framework with which hypotheses can be formulated must be described.

3.2.1 The Serious Leisure Perspective: A Definition and its Different Types

The definition of leisure used in this project is the following:

Definition 4

> *"…Uncoerced* [*sic*] *activity engaged in during free time, which people want to do and, in either a satisfying or a fulfilling way (or both), use their abilities and resources to succeed at this"* (Stebbins, 2007, p. 4).

A key expression in the above definition is "free time", which Stebbins further described as:

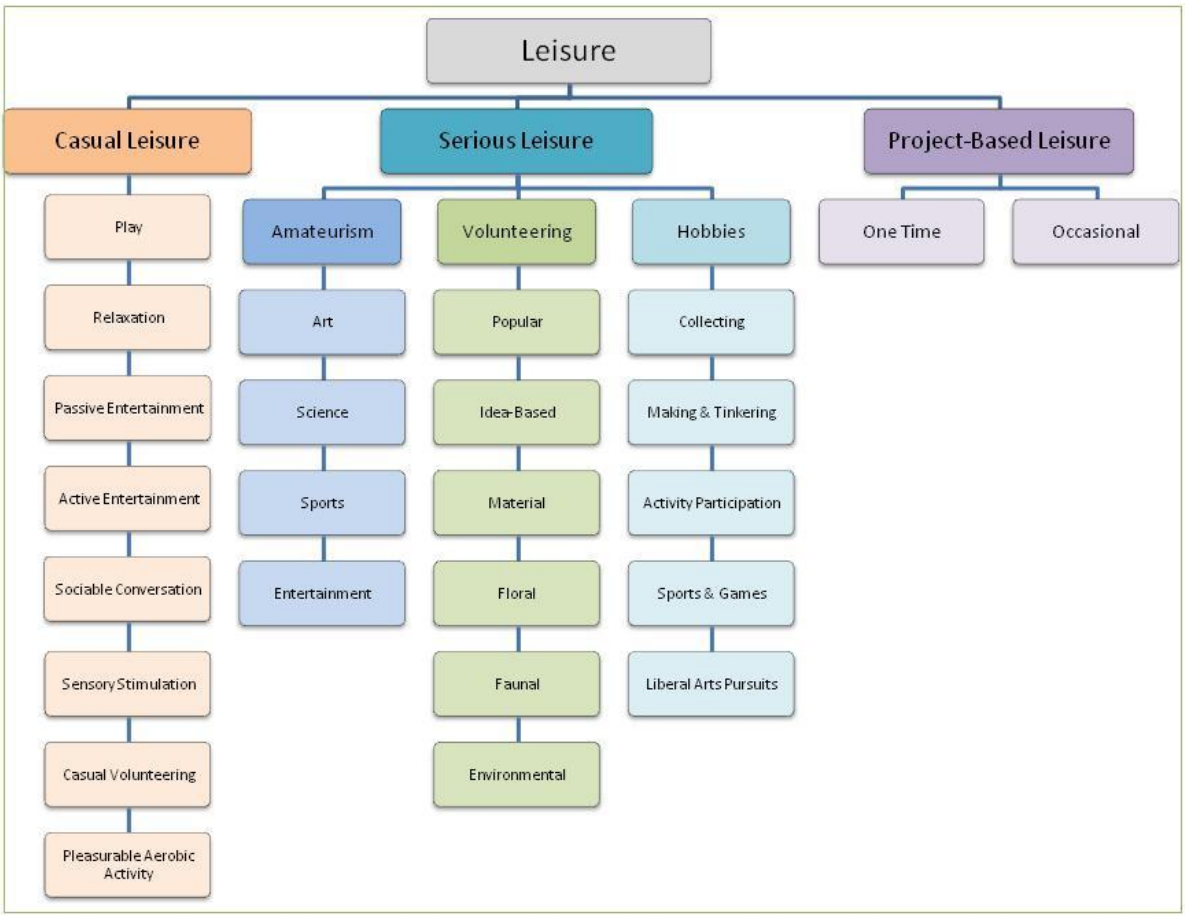
Definition 5

> *"…time away from unpleasant obligation, with pleasant obligation being treated here as essentially leisure since homo otiosus, leisure man, feels no significant coercion to enact the activity in question"* (Stebbins, 2007, p. 4).

This important distinction basically separates those who do an activity either professionally (paid work which is their main source of income) or by necessity (chores), and those who do not.

A graphical representation of the different types of leisure, and the type of activities they include, can be found in Figure 19.

Figure 19. The Serious Leisure Perspective (Hartel, 2007).



The leisure activities that *homo otiosus* may freely choose to pursue in his free time can be further delineated into the following three categories.

1. **Casual Leisure:** "An immediately, intrinsically rewarding, relatively short-lived pleasurable core activity, requiring little or no special training to enjoy it" (Stebbins, 1997, p. 18).

   Eight types of casual leisure have been found over the years. They are:

1. "Play (including dabbling, dilettantism)
2. Relaxation (e.g., sitting, napping, strolling)
3. Passive entertainment (e.g., through TI, books, recorded music)
4. Active entertainment (e.g., games of chance, party games)
5. Sociable conversation (e.g., gossip, "idle chatter")
6. Sensory stimulation (e.g., sex, eating, drinking, sightseeing)
7. Casual volunteering (e.g., handing out leaflets, stuffing envelops [*sic*])
8. Pleasurable aerobic activity" (Stebbins, 2007, p. 39)

2. **Project-Based Leisure:** "it is a short-term, moderately complicated, either one-shot or occasional, though infrequent, creative undertaking carried out in free time" (Stebbins, 2005, p. 2).

   As the definition above implies, there are two types of project-based leisure activities: one-time (e.g., a trip, do-it-yourself projects), and occasional (e.g., hosting dinner parties).

3. **Serious Leisure:** it "… is the systematic pursuit of an amateur, hobbyist, or volunteer core activity that people find so substantial, interesting, and fulfilling that, in the typical case, they launch themselves on a (leisure) career centered on acquiring and expressing a combination of its special skills, knowledge, and experience" (Stebbins, 2007, p. 5).

3.2.2 Serious Leisure in Detail

There are six distinguishing qualities that characterize those who partake in serious leisure activities (Gould, Moore, McGuire, & Stebbins, 2008, p. 48). They are:

1. **Perseverance**; the idea that a person sticks with an activity despite its occasional difficulties
2. **Leisure career**; not in a professional sense, but nonetheless recognized by the long-standing commitment and acquired knowledge and experience related to the serious leisure activity.
3. **Effort**; aplication in using acquired knowledge, training, experience, and skill.
4. **Durable outcomes**; they "… represent a realization of an agreeable or desired outcome, anticipated or not, that is more appealing and desirable than the previous existing state or condition" (Gould, Moore, McGuire, & Stebbins, 2008, p. 49). Examples include self-accomplishment, self-actualization, and self-gratification, and can be experienced personally or socially (in a group).
5. **Unique ethos**; it "…is the spirit of community of serious leisure participants, as manifested in shared attitudes, practices, values, beliefs, and so on" (Stebbins, 2007, p. 12).
6. **Identification with pursuit**; the strong inclination an individual has towards the leisure activity.

These qualities will be used later in one of the instruments to determine if those that are into astrocasting consider it a serious leisure activity.

3.2.3 Types of Serious Leisure

Serious leisure activities can be subdivided into three types (Stebbins, 2007, p. 25);

1. **Hobbyist activities**; these are the serious leisure activities that fall in the five following categories: collectors, makers and tinkerers, non-competitive activity participants, non-competitive sports and games participants, and liberal arts enthusiasts.
2. **Volunteering activities**; it is "…uncoerced [*sic*] help offered either formally or informally with no or, at most, token pay and done for the benefit of both other people and the volunteer" (Stebbins, 2007, p. 30). This type of activity is defined by the following four dimensions: free choice, remuneration (avoidance of economic dependence on any compensation given), structure, and intended beneficiaries.
3. **Amateur activities**; the partakers of these activities (in arts, science, sport, and entertainment) "… are inevitably linked, one way or another, with professional counterparts who coalesce, along with the public whom the two groups share, into a three-way system of relations and relationships (the professional-amateur-public relationship, or P-A-P system)" (Stebbins, 2007, p. 6).

In many fields of amateur astronomy, such as in lunar and planetary observations and variable stars, there has long been a deep connection between amateur astronomers and professional astronomers and physicists (Williams, 2000, p. 351). If those involved in astrocasting consider it a serious leisure activity, astrocasting itself, being a further extension of

amateur astronomy, can be classified in the amateur activities category as defined above.

3.2.4 Rewards of Serious Leisure

Serious leisure participants have reported, over the years, many rewards derived from their activities. The latest research has found ten such rewards, divided into personal rewards and social rewards. According to Stebbins (Stebbins, 2007, p. 14), they are:

Personal rewards

1. "Personal enrichment (cherished experiences)
2. Self-actualization (developing skills, abilities, knowledge)
3. Self-expression (expressing skills, knowledge already developed)
4. Self-image (known to others as a particular kind of serious leisure participant)
5. Self-gratification (combination of superficial enjoyment and deep fulfillment)
6. Re-creation (regeneration) of oneself through serious leisure after a day's work
7. Absence of or lack of significant financial return (from a serious leisure activity)

Social rewards

1. Social attraction (associating with other serious leisure participants, with clients as a volunteer, participating in the social world of the activity)
2. Group accomplishment (group effort in accomplishing a serious leisure project; senses of helping, being needed, being altruistic)
3. Contribution to the maintenance and development of the group (including senses of helping, being needed, being altruistic in making the contribution)"

People undertake their serious leisure activities because they have a feeling that the rewards outweigh the costs. These rewards are factors that are used in the Serious Leisure Inventory and Measure instrument (Gould, Moore, McGuire, & Stebbins, 2008, p. 47), which will be described later in the methodology when discussing astrocasting as a serious leisure activity.

This difference between rewards and costs is a general definition of motivation, which will be explored in depth in the following section.

3.3 Motivation Models

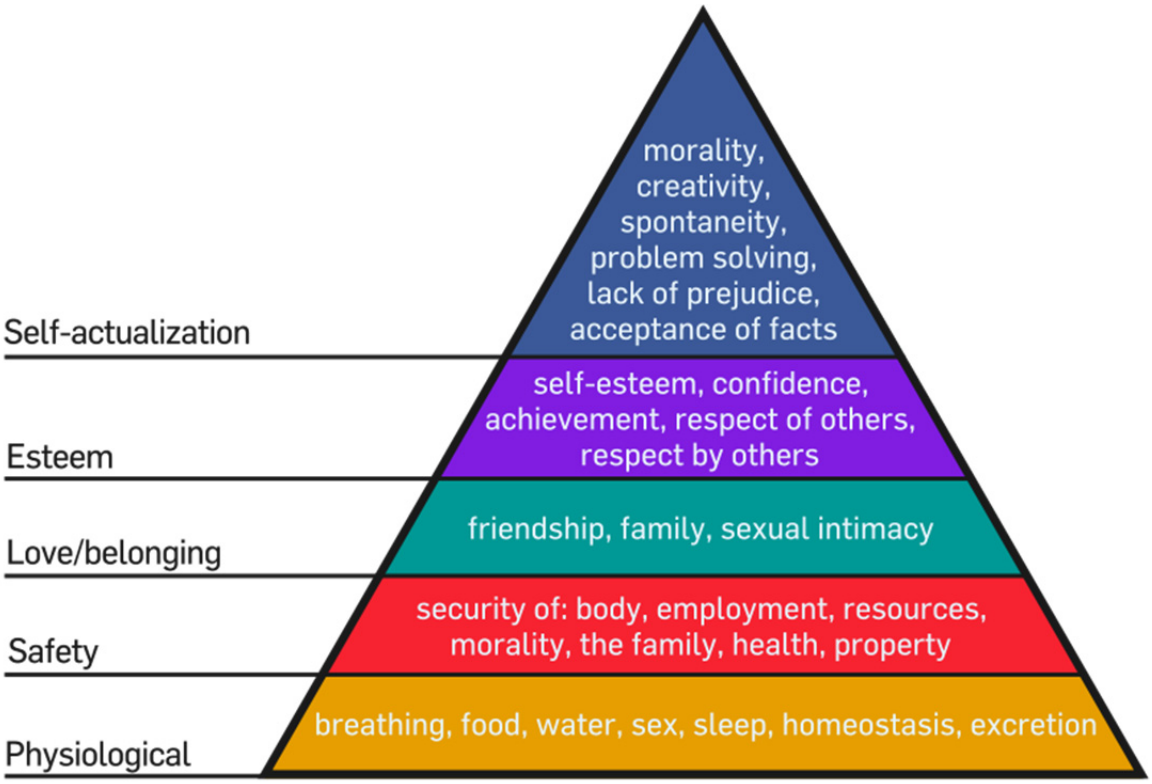
Each situation has its own set of reasons why participants partake in serious leisure activities. In the case of the development of the GNU/Linux operating system, an open-source development project for which programmers volunteer their time, the engagement of the participants has been reported as being "… determined by their identification as a Linux developer, by pragmatic motives to improve own software, and by their tolerance of time investments" (Hertel, Niedner, & Herrmann, 2003, p. 1159). However, the list of reasons for participating in any activity, if compiled, would be very long. Instead, choosing a motivation model to observe and describe the behavior of those involved in leisure activities would be much more sensible.

A cursory look at current models of motivation reveals a plethora of theoretical models; six are enumerated by Legendre (Legendre, 2005, p. 915). Here is a brief look at each one of them.

3.3.1 Humanist Approach

First published in 1943, Abraham H. Maslow's humanist approach to motivation relies on the hierarchy of basic human needs (Maslow, 1943). They range from physiological (most basic need), to safety, to love/belonging, to esteem, and finally to self-actualization. It is often represented as a pyramid, with self-actualization being at the top and physiological needs at the bottom.

Figure 20. Maslow's Hierarchy of Needs (Wikipedia, 2009).



To achieve the top level of self-actualization, seen "... as the ultimate level of psychological development" (Plaut & Markus, 2005, p. 472), a person has to satisfy the underlying

levels, in the order mentioned above.

An extensive literary research done by two researchers has severely criticized this theory:

"A large number of cross-sectional studies showed no clear evidence for Maslow's deprivation/domination proposition except with regard to self-actualization. Longitudinal studies testing Maslow's gratification/activation proposition showed no support, and the limited support received from cross-sectional studies is questionable due to numerous measurement problems" (Wahba & Bridwell, 1976, p. 212).

Finally, any activity, such as developing the GNU/Linux Operating System, that finds itself at two levels of human needs as described above (Esteem for the identification as a Linux developer, and self-actualization for the pragmatic motives to improve own software) directly contradicts Maslow's hierarchy, since self-actualization cannot be achieved without having satisfied the Esteem need first. Therefore, this theory will not be considered further.

3.3.2 Anticipative Approach

This approach is based mainly on the anticipation of the result which initiates, drives, and sustains the behaviour in question (Legendre, 2005, p. 916). Kurt Z. Lewin postulated that any behaviour must take into consideration the person and the environment (Lewin, 1936, p. 12), described in mathematical language as follows:

Equation 1. Lewin's Equation.

$$B = f(PE)$$

Where

$$B = Behaviour$$

$$P = Person$$

$$E = Environment$$

This equation is heuristic, in that the quantities B, P, and E cannot be quantified, making it very subjective. Its latest application is in the field of robotics, in the form of Field Theory, where behaviour is considered purely reactive (Balkenius, 1995, p. 79).

A second pioneer of the anticipative approach, John W. Atkinson, theorized that people are motivated by achieving success and avoiding failure, which he also developed into a mathematical equation:

Equation 2. Atkinson's Theory of Achievement Motivation.

$$T_a = T_s + T_{-f} + T_{est}$$

Where

$$T_a = An\ active\ impulse\ to\ undertake\ a\ particular\ activity$$
$$T_s = Impulse\ to\ achieve\ success$$
$$T_{-f} = Impulse\ to\ avoid\ failure$$
$$T_{est} = Positive\ extrinsic\ tendency\ to\ perform\ the\ activity$$

As with Lewin's equation, the equation is heuristic, and the terms are the product of test results from psychometric questionnaires and subjective estimates of probability (Maehr & Sjogren, 1971, p. 157), thus making objective measurements of motivation nearly impossible and rendering it unusable to objectively measure the level of motivation in the participants of this study.

3.3.3 Behavioural and Neo-Behavioural Approaches

Focusing on the stimulus-response link, this approach "...considers that all behaviour is provoked by a stimulus and that it ceases when the latter disappears" (Legendre, 2005, p. 916). It was first proposed by Ivan P. Pavlov in the early 20th century following his research in the physiology of digestion in dogs, and he later postulated a theory of classical conditioning (stimuli-response) after noticing the behaviour of the dogs when he rang a bell at feeding time.

This perspective has evolved into a theory of motivation that categorizes goal-oriented behaviour as either having an approach motive or an avoidance motive (Gable & Strachman, 2008, p. 562). This leads a person to behave in a way that regulates his/her affective reactions, and the ultimate expression of this is a person's tendency towards hedonism. Hence, "according to a hedonistic account, people engage in affect regulation because this helps them to enhance pleasurable feelings and to avoid painful feelings" (Koole & Kuhl, 2008, p. 296).

While the behavioural approach is based on measurable responses to a stimuli, benefitting from an ease of obtaining objective results in research, it fails to take into account the

"richness of (any) theory that allows for more comprehensive theorizing and considers human experience as well as human behaviour" (Deci & Ryan, 1985, p. 188). In other words, while the theory might predict the occurrence of a response to stimuli, it fails to explain why. And since this project is concerned about the reasons that astrocasters do what they do, this theory is therefore inadequate.

3.3.4 Cognitive Dissonance Approach

Leon A. Festinger first postulated his theory of "Cognitive Dissonance" in 1957. Based on self-knowledge, termed cognition, the theory "… posits a motivation to reduce relevant and important cognitive inconsistencies" (Fiske, 2008, p. 11). The person therefore seeks to minimize inconsistencies (termed dissonance) between competing elements in his consciousness and will act to achieve consistency (termed consonance).

Festinger based his theory on the following two hypotheses:

1. "The existence of dissonance, being psychologically uncomfortable, will motivate the person to try to reduce the dissonance and achieve consonance.
2. "When dissonance is present, in addition to trying to reduce it, the person will actively avoid situations and information which would likely increase the dissonance" (Festinger, 1957, p. 3).

A recent example of dissonance can be found in a study of nurses who smoke (Radsma & Bottorff, 2009, p. 443). The authors have found that the study subjects rationalized their ambivalence, therefore trying to minimize the dissonance between the health dangers of

smoking and their role as health care providers. Elliot Aronson postulates that people do so for the following reasons:

1. "To preserve a consistent, stable, predictable sense of self.
2. To preserve a competent sense of self.
3. To preserve a morally good sense of self." (Aronson, 1992, p. 305).

This perspective implies that an individual is motivated to minimize dissonance and maximize consonance. The methods developed for this theory can also be applied to groups to study social psychological phenomena; the theory then becomes the social cognitive approach (Ferguson, Hassin, & Bargh, 2008, p. 152).

3.3.5 Social-Cognitive Approach

The social-cognitive approach is a theory that traces its origin to the social learning theory initially proposed by N.E. Miller and J. Dollard, and further refined by the Canadian psychologist Albert Bandura. This approach to motivation "is concerned primarily with people's expectations about whether reinforcements are contingent on their behaviour" (Deci & Ryan, 1985, p. 224). Said differently, an individual's behaviour is highly dependent on his or her expectations of success or failure, and their perceived efficacy at achieving a goal and/or matching an observed performance that the individual wishes to replicate (Gerst, 1971, p. 90).

Deci and Ryan have criticised this approach because it does "… not (recognize) the intrinsic satisfaction of efficacy…" (Deci & Ryan, 1985, p. 224), since their model (described

below) takes into account the fact that being part of an activity or executing a task can be motivation elements in themselves.

3.3.6 Self-Determination Theory

The Self-Determination Theory (SDT), pioneered by Deci and Ryan, is used in as diverse fields as sports, psychotherapy, work, and leisure. It is based on an individual's "... capacity to choose and to have those choices, rather than reinforcement contingencies, drives, or any other forces or pressure, be the determinants of one's actions" (Deci & Ryan, 1985, p. 38).

The section of this theory that deals with leisure activities is the Organismic Integration Approach, which "... is based on the assumption that people are naturally inclined to integrate their ongoing experiences..." (Ryan & Deci, 2002, p. 15). In other words, the individuals are motivated to make their behaviours entirely their own.

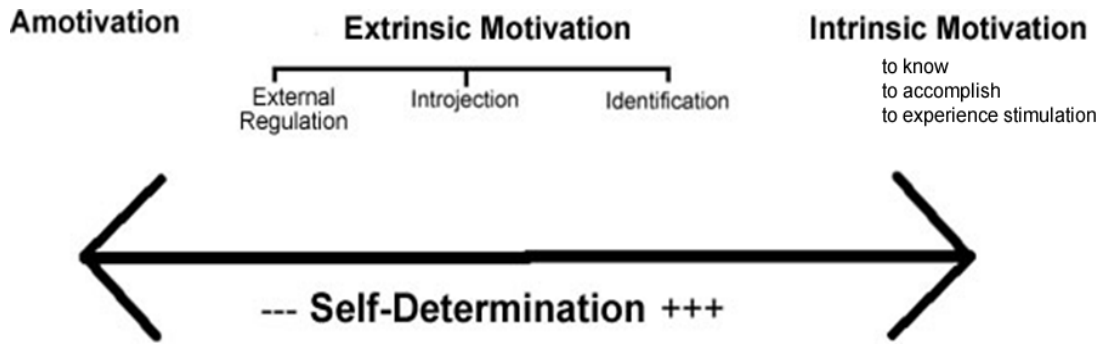
In this approach, motivation is defined as follows: "Hypothetical construct used to describe internal and/or external forces producing the triggering, direction, intensity, and persistence of the observed behavior" (Legendre, 2005, p. 917).

According to SDT, there are different types of motivation that distinguish themselves by the level of self-determination that underlies the behavior (Pelletier L. G., Vallerand, Green-Demers, Brière, & Blais, 1995, p. 142). They are defined as follows (Vallerand & Ratelle, 2002, pp. 42-43):

- **Intrinsic motivation (IM):** "IM implies engaging in an activity for the pleasure and satisfaction inherent in the activity."
- **Extrinsic Motivation (EM):** "… EM refers to a broad array of behaviours having in common the fact that activities are engaged in not for reasons inherent in them but for instrumental reasons."
- **Amotivation (A):** "… a relative absence of motivation."

For any given behavior, there can be an evolution of its internalization on the Self-Determination Continuum, as in Figure 21.

Figure 21. Illustration of the Self-Determination Continuum, adapted from Legendre (Legendre, 2005, p. 917).



Pelletier *et al*. describe the situation in Figure 21 as follows: "According to Deci and Ryan (1985), the different types of motivation defined above can be placed on a continuum depending on their level of self-determination. Intrinsic motivation, because it underlies the behaviours that are triggered freely and for pleasure, represents the highest level of self-determination. Amotivation represents the type of motivation that is least self-determined since it represents an absence of control. The different types of extrinsic motivation are

placed between these opposite poles" (Pelletier L. G., Vallerand, Green-Demers, Brière, & Blais, 1995, p. 144).

The scale in Figure 21 shows three sub-levels of extrinsic motivation: external regulation, introjection regulation, and identification regulation. They are defined as follows (Deci & Ryan, 2002, p. 17):

- **External regulation (EM-ER):** It "… is the least autonomous form of extrinsic motivation and includes the classic instance of being motivated to obtain rewards or avoid punishments."
- **Introjection regulation (EM-IR):** It "… involves an external regulation having been internalized but not, in a much deeper sense, truly accepted as one's own."
- **Regulation through identification (EM-ID):** It "… is a more self-determined form of extrinsic motivation, for it involves a conscious valuing of a behavioral goal or regulation, an acceptance of the behavior as personally important."

There are also three types of intrinsic motivation, all located at the right of the scale and all equivalent. Here are their definitions (Pelletier L. G., Vallerand, Green-Demers, Brière, & Blais, 1995, p. 143):

- **IM to know (IM-K):** "A person is intrinsically motivated to know when it is engaged in an activity for the pleasure it feels when learning something new."

- **IM to accomplish (IM-A):** "A person is intrinsically motivated to accomplish when it is engaged in an activity for the pleasure of feeling efficient and competent."
- **IM to experience stimulation (IM-S):** "A person is intrinsically motivated to experience stimulation when it is engaged in an activity for the purpose of the special feelings it provides."

Many instruments exist that can measure quantitatively the level of motivation, and one in particular, the Leisure Motivation Scale (LMS), applies to leisure activities (Pelletier L. G., Vallerand, Brière, & Blais, 1989). It will be described later in the Methodology section.

3.4 Conclusion

In this section, the three fields of research involved with this project have been described in detail. First, the relevant elements of social media were explored, and have been used to briefly describe qualitatively the phenomenon of astrocasting.

The second field, the Serious Leisure Perspective, provides the necessary framework to study quantitatively the involvement of those involved in astrocasting.

Lastly, the review of the motivational models within the field of psychology have revealed that the Self-Determination Theory of Motivation allows the study of the level of motivation of individuals involved in astrocasting in a quantitative fashion.

4. Theoretical Framework

In this section, the theoretical framework used to study the way astrocasters engage in this leisure activity is described using the three research paradigms from the previous section; Social Media, the Serious Leisure Perspective, and the Self-Determination Theory of Motivation.

4.1 Social Media and Astrocasting – Bringing the Observatory Home

Astronomy, as a leisure activity, has progressed rapidly in the second half of the 20th century. Three specific developments stand out as having made astrocasting possible:

1. The easy availability and affordability of homebuilt telescopes, and mass-produced computerized telescopes later on;
2. The invention of the Mallincam, a camera capable of displaying live images of deep-sky objects, with or without the presence of light pollution; and
3. Free Internet streaming of observing sessions on a dedicated Web site that enables interactive communication between all the participants, including the broadcaster.

The first two innovations (accessibility of astronomical equipment and invention of the Mallincam) are the result of technological progress achieved in the field of amateur astronomy in the last few decades, and represent the portion of astrocasting that relates to the User Generated Content paradigms specified in Definition 3.

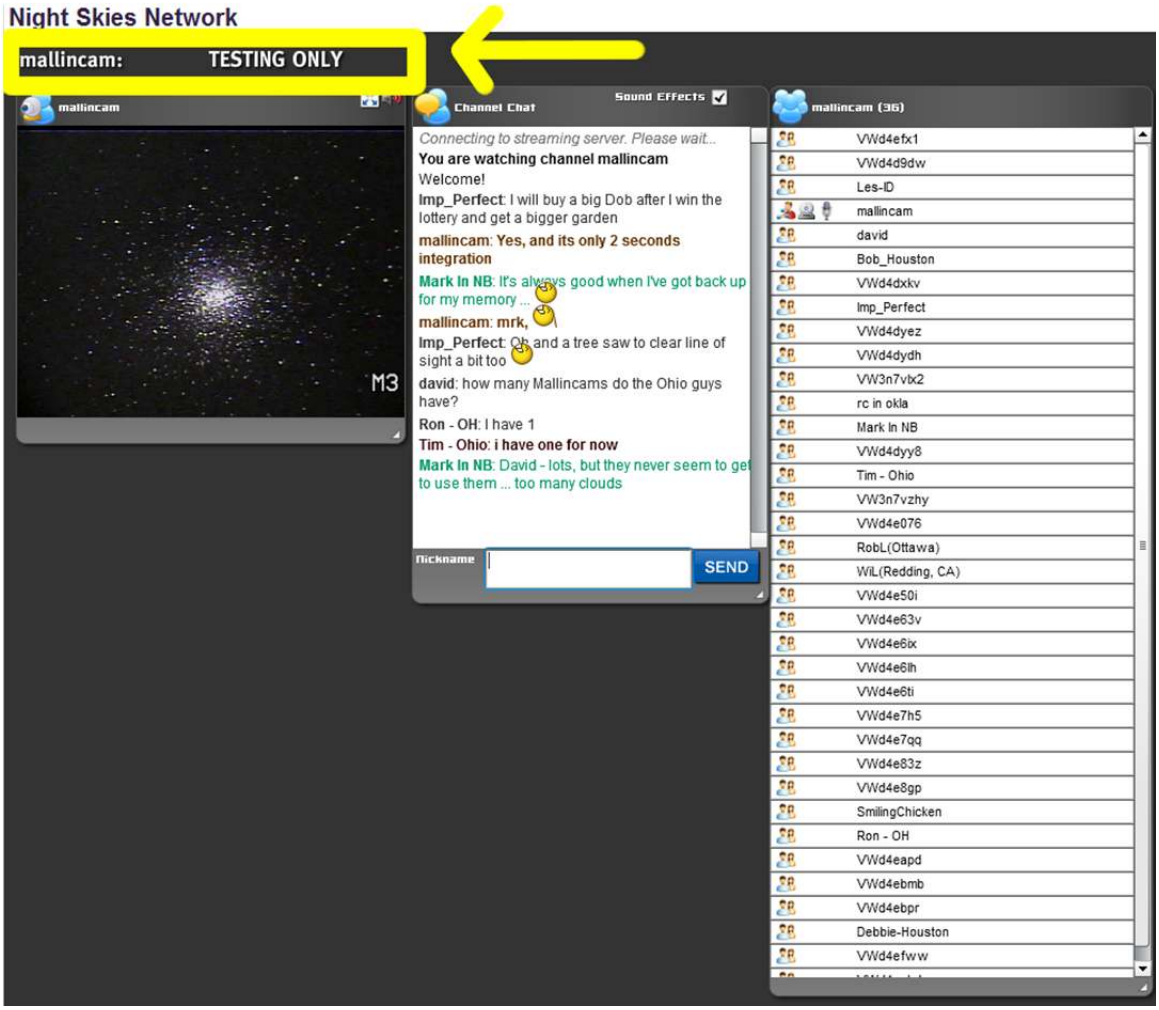
The third development, the part that requires the use of the Internet, has itself become widely accessible recently because of the availability of applications that enable the broadcaster to easily share his content (i.e. the astronomical observation sessions) with the viewers; this part corresponds to the section of Definition 3 in which the Internet-based applications and Web 2.0 (easy sharing of digital content) are used.

4.1.1 The Meeting Point

Since 2002, the use of the Internet as an electronic gathering point for people has increased dramatically (boyd [*sic*] & Ellison, 2008, p. 211). The site that is of interest in this study, Night Skies Network (http://www.nightskiesnetwork.com) , is itself a virtual meeting place for people who want to share their views of astronomical targets live as they observe them (astrocasting). It meets all three necessary elements from Definition 2 in that:

(1) An astrocaster, upon logging on the Night Skies Network, creates a profile which describes his or her activities; these details are usually shown on top of the viewing page, and can only be seen by the viewers once they have logged on, as seen in Figure 22;

Figure 22. The profile information for "mallincam", highlighted in yellow. Note that the astrocaster wrote "Testing only" to indicate that he was testing his setup using Messier Object #3; de-spite this, the number of viewers logged on to view and interact with others was around 36 (retrieved on January 12, 2011).

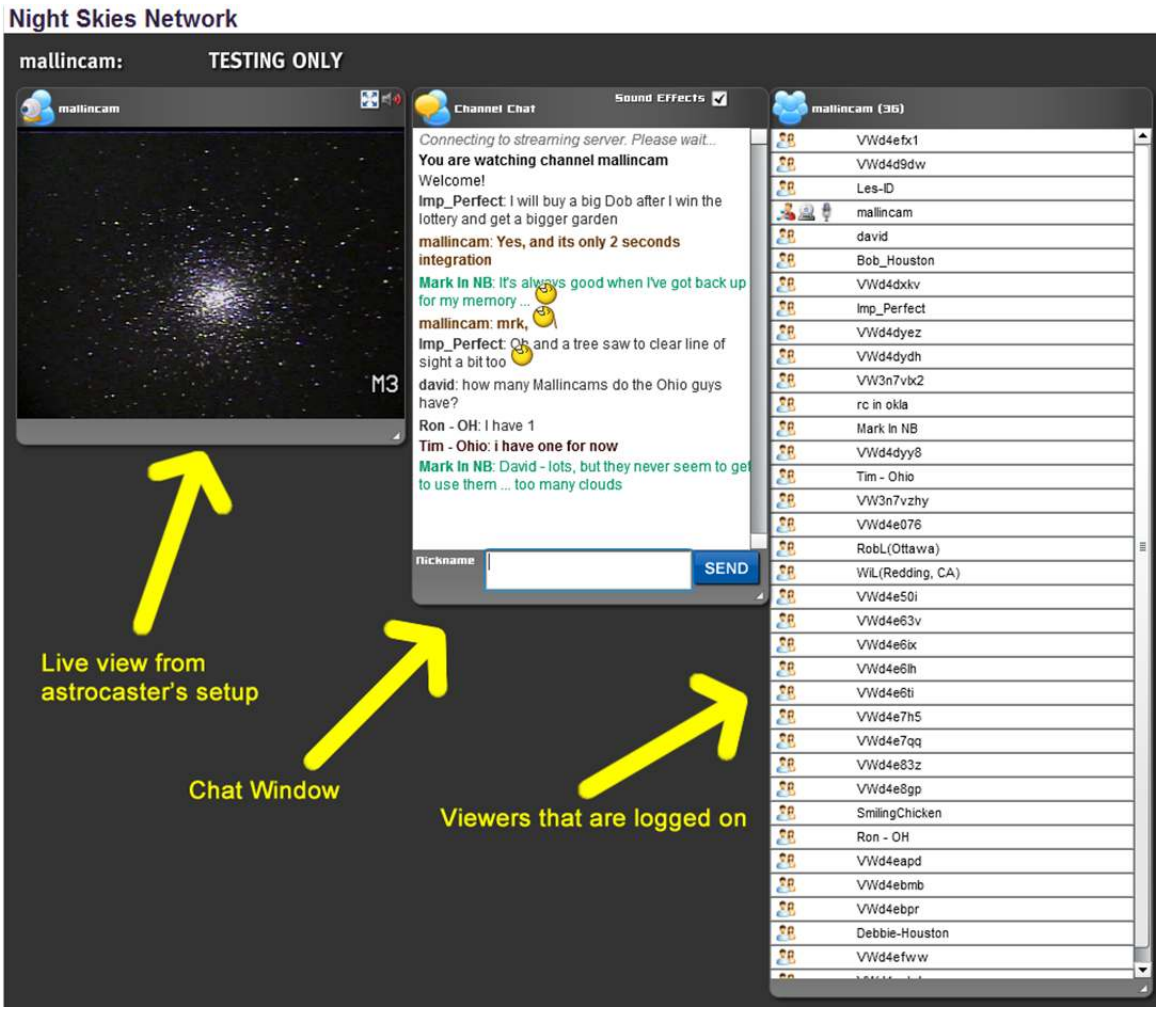


(2) All the pages (or channels) that have been set up for astrocasters can be browsed once an astrocaster or a viewer has logged on (Figure 23); and

Figure 23. Page on the Night Skies Network site that shows all the 287 channels that have been set up for astrocasters by the Night Skies Network administrator. The one listed in red was broadcasting at the time of the screen capture (retrieved on January 12, 2011).

(3) The astrocaster and viewers have a window that shows who is logged on the channel (Figure 24).

Figure 24. The astrocaster's live broadcast page (or channel), which includes: live view from astrocaster's setup, the chat window, and the list of 36 viewers that are logged on (retrieved on January 12, 2011).



4.1.2 The Conduct of the Meetings

4.1.2.1 The Viewers

Viewers that land on at NightSkiesNetwork.com see a brief description of the site, as well as all the available channels, including those that are currently broadcasting (shown in red on Figure 23 on page 54). Upon clicking the link to an ongoing astrocast, they arrive on the channel's page (Figure 24 on page 55), where they: a) see the live video feed, b) hear the audio commentary provided by the astrocaster's setup, c) have access to the chat window where text messages can be exchanged between all that are logged on, and d) see the list of viewers. At this point, they can participate in the generation of content by interacting with others in the chat window.

During an astrocasting session, it is not unusual to have another astrocaster or an experienced amateur astronomer logged on as a viewer so he or she can provide guidance and extra commentary during the session. Indeed, this has been used often in the past to help astrocasters when they use NightSkiesNetwork.com for the first time. Also, other viewers have often made requests for different targets in the skies. Finally, detailed descriptions of these targets can be provided by the more experienced amateur astronomer who wishes to share his or her knowledge.

From the viewers' perspective, the combination of live detailed views of astronomical targets, accompanied by the audio comments provided by the astrocaster, the text chat where other viewers provide their expertise on the astrocasting session, and the targets viewed, add up to a rich environment where all can benefit from the resulting user-generated content.

4.1.2.2 The Astrocasters

When an astrocaster wants to start a live broadcast, he or she goes to the NightSkiesNetwork.com's main page, where he follows a link to the login page. Then, after providing the required credentials, the channel's main page appears. From here, he or she clicks on the video feed's window (shown in gray at this point) to activate the connection to his or her computer, where both the Mallincam video feed and the audio commentary are generated. At this point, while adjusting some settings (brightness, contrast, and volume, for example) the astrocaster's interactions with the viewers can be made either with the chat window or the audio feed.[2] Usually, during an astrocasting session, the channel owner will make some minor tweaks to the settings of the Mallincam to provide optimal views of the astronomical target.

As mentioned in the previous section, it is the interaction between the viewers and the astrocaster that provides a rich source of information to all. Therefore, from the astrocaster's perspective, he or she can benefit greatly from the user-generated content provided by others in the chat window, as well as provide his or her own via the chat window and the video and audio feeds that are the main anchors to the channel.

4.1.3 The Subject of the Meetings

The main subject of the astrocasts, astronomy, is not a mainstream leisure activity; it does not even appear in the top fifty of leisure activities in America (Harris Interactive Inc., 2008). But as Anderson argues, even if the popularity of a leisure activity is way to the right

[2] It is important to note that the channel's availability for viewing starts immediately after the astrocaster has logged in, thus giving opportunity for other astrocasters (and others interested in the process) to log in as viewers and help the channel's owner to set up.

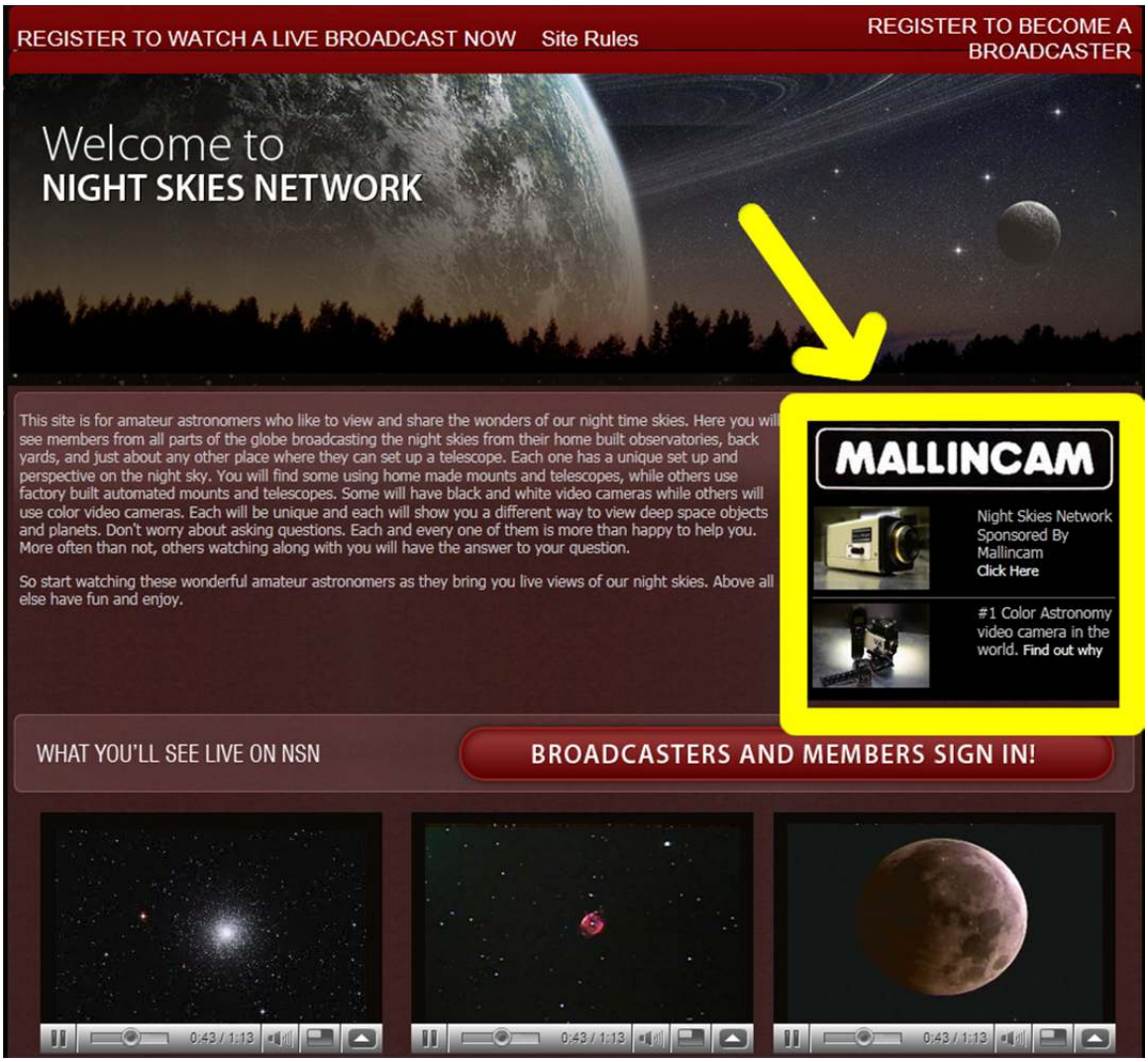
of a Long Tail graph, it is not zero (Anderson, 2008, p. 21), i.e. there will always be some people interested in any given subject.

As more and more people shift their leisure time from the television to the computer (IBM Business Consulting Services, 2006) it is only natural that they seek out what interests them the most. We only need to look at the variety of material on YouTube to notice that the topics are almost as numerous as the viewers themselves. If we were to rank the videos by popularity and measure the number of downloads for each of them, we would notice a Long Tail pattern (Anderson, 2008, p. 192), with the viral videos having the largest number of downloads, and all the others being downloaded in decreasing number, yet never reaching zero. In essence, people will converge naturally to what interests them the most, which is now made very easy thanks to Internet search engines.

4.1.4 Admission Fee = $0.00

The key element in the three innovations mentioned at the beginning of this section is the word "free" found in number 3. The Night Skies Network site (http://www.nightskiesnetwork.com) costs nothing to both the astrocasters and the viewers, and yet, the operating expenses have been dealt with. How can this be?

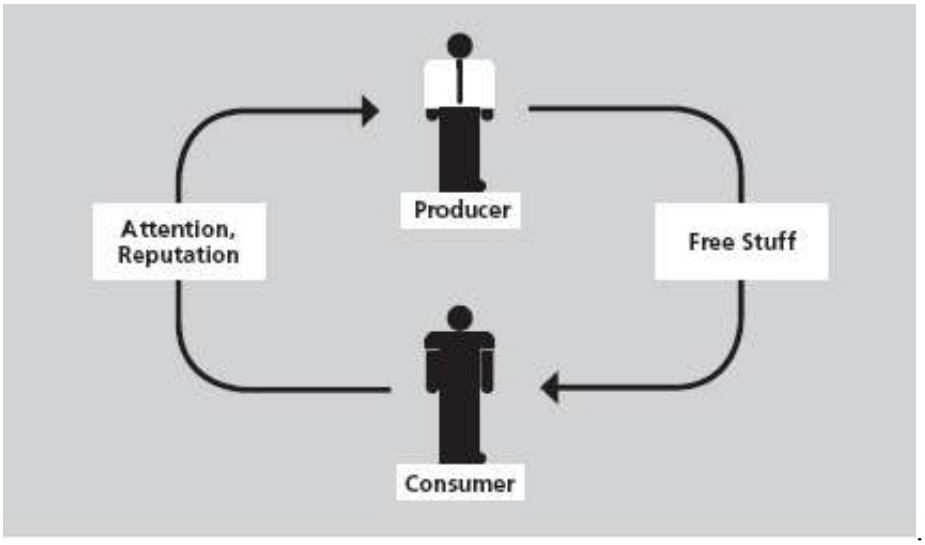
Figure 25. Main page of the Night Skies Network with the sponsor highlighted (retrieved on January 12, 2011).



As can be noted from the main page of the Night Skies Network in Figure 25, the only sponsor of this social media site is Mallincam. Since there are no financial contributions expected from either the astrocasters or the other users of this site, and given that Rock Mallin sponsors the site out of a sense of altruism to promote astronomy (Mallin, Personal communication, 2009), the business model evidenced here is the Nonmonetary market, as

discussed previously on page 32 and illustrated in Figure 26.

Figure 26. The Nonmonetary Market Model (Anderson, 2009, p. 28).



4.1.5 Ancillary Fees = $0.00

Of the many disadvantages of astronomy as a leisure activity, the initial cost in the order of a few hundred dollars at the very least, along with a very steep learning curve if any purchased instrument is to be used to its full potential, can limit the popularity of the hobby. Saddling people who are new to the hobby with a substantial initial investment is not a good plan for increasing its reach, as they might balk at making the investment and look for cheaper (and free) options. This point is illustrated with the failure of the Cosmocasts web site, which had a similar goal to that of the Night Skies Network, where the content providers were begging for contributions that never came (Astrochannels, 2006).

Tempering these fears of equipment costs, however, are the innovators and early enthusiasts among amateur astronomers – those who have always been keen to share their hobby anyway – who will pay whatever amount to be in the first wave of any new technology, be it fancy telescopes or exotic cameras. In essence, they pay for the equipment.

In short, the genius of the Night Skies Network for newcomers to astronomy can be reduced to three points: no viewer has to physically stand next to the astrocaster to share his or her equipment; no viewer has to purchase any astronomical equipment to appreciate live images of the night sky, as they use that of the astrocasters; and the learning curve is spared for the viewers by the astrocasters who have surmounted all the technical obstacles to make it to the stage where they can stream their observations to the Night Skies Network. In other words, the astrocasters share the observations, for free, via the Internet instead of standing next to the equipment.

4.1.6 Meeting Recap

As a result of the eagerness of amateur astronomers to share their observations with others, and the streaming on the Internet of said astronomical observations, casual viewers can share these observations and have a feel of what live astronomy is all about; indeed, they may come to appreciate the technical hurdles that go into producing a site such as Microsoft's Worldwide Telescope (http://www.worldwidetelescope.org), where images from great telescopes on Earth and in orbit are superimposed on a map of the night skies, along with all the technical data available to date on every astronomical target explored.

The Night Skies Network social media site has allowed anyone to take part in live astronomical observations. This removal of the tyranny of locality of having to observe while being present physically at the telescope has given a new audience to astronomers who can overcome all the technical difficulties to become astrocasters. It is therefore important that an exploration, in the form of a focus group, be made to add to our understanding of this emerging phenomenon that is astrocasting. The methodology to go about this exploration will be further described in the next chapter.

4.2 Astrocasting and the Serious Leisure Perspective

The Serious Leisure Perspective, as developed by Stebbins (Stebbins, 2007) and previously detailed in the Literature Research chapter, provides a systematic framework that can be used to study all leisure activities.

In Stebbins' definition of leisure (Definition 4), the concept of "free time" is key in differentiating what is leisure and what isn't, described in Definition 5 as time away from obligations. This characterization of time spent on astrocasting as being free or not will be used later, as described in the Methodology chapter on page 84, to establish the eligibility for inclusion of each individual in the sample population based on their response to this question. This allows the discrimination of those who partake in astrocasting as a leisure activity, and those who do it for other motives.

4.2.1 What Kind of Leisure Activity is Astrocasting?

Amateur astronomy has a long tradition of cooperation and emulation of professional astronomers throughout history (Williams, 2000, p. 351). In fact, some amateur astronomers

are so involved in their leisure activity that NASA regularly asks them to participate in their research projects after they get noticed for their high-calibre work.

A case in point is the re-emergence of one of the main bands on Jupiter in 2010. The band, called the South Equatorial Belt, had mysteriously disappeared early in 2010. Later that year, Christopher Go, an amateur astronomer from Cebu City in the Philippines, caught the first signs of it coming back while taking images of the giant planet. Shortly after publishing these images on the Internet, NASA pointed one of its main instruments from the Infrared Telescope Facility on Mauna Key in Hawaii, and two other professional telescopes there followed suit, thus capturing the attention of professional scientists around the world on the fast-emerging phenomena which they would have otherwise missed (NASA, 2010).

The Serious Leisure Perspective offers the opportunity to study leisure activities by classifying them into three categories: casual, project-based, and serious. The definition adopted for a serious leisure activity for this research project is the following:

Definition 6

> *It "... is the systematic pursuit of an amateur, hobbyist, or volunteer core activity that people find so substantial, interesting, and fulfilling that, in the typical case, they launch themselves on a (leisure) career centered on acquiring and expressing a combination of its special skills, knowledge, and experience"* (Stebbins, 2007, p. 5).

If those involved in astrocasting consider it as an amateur activity (being a further extension of amateur astronomy) within the serious leisure activity definition, astrocasting itself can therefore be hypothesized as being a serious leisure activity.

Hypothesis H_1

> *The population studied considers astrocasting as a serious leisure activity.*

As this research project looks specifically at astrocasters, who have typically spent a considerable amount of time to learn the basics of astronomy before even attempting to become astrocasters, this research project will not consider the possibility that astrocasting is a casual leisure activity, since it is defined *a priori* as an activity that requires little or no training in order to be enjoyed.

4.2.2 Distinguishing Qualities for Astrocasting

According to Stebbins (Stebbins, 2007), there are six distinguishing qualities that allow the differentiation of those who partake in astrocasting as a project-based leisure and those who don't; however, this requires that their definitions be modified to specify astrocasting as the activity under study. The adapted definitions are as follows:

1. **Perseverance:** The idea that a person sticks to astrocasting despite its occasional difficulties.
2. **Leisure career:** Not in a professional sense, but nonetheless recognized by the long-standing commitment and acquired knowledge and experience related to astrocasting.
3. **Effort:** Application in using acquired knowledge, training, experience, and skill towards astrocasting.
4. **Durable outcomes:** They "… represent a realization of an agreeable or desired outcome, anticipated or not, that is more appealing and desirable than the previous existing state or condition" (Gould, Moore, McGuire, & Stebbins, 2008, p. 49). Examples include self-accomplishment, self-actualization, and self-gratification, and can be experienced personally or socially (in a group), as applied to astrocasting.
5. **Unique ethos:** It "…is the spirit of community of (astrocasters), as manifested in shared attitudes, practices, values, beliefs, and so on " (Stebbins, 2007, p. 12).

6. **Identification with pursuit:** The strong inclination an individual has towards astrocasting.

The main idea that can be extracted from the above is that of longevity, or persistence, in an individual's involvement in astrocasting. This element is therefore crucial in the determination of astrocasting as a serious leisure activity for its participants.

4.2.3 What's in it for Astrocasters?

A majority of people undertake their serious leisure activities because they have a feeling that the rewards outweigh the costs. As stated in the Literature Research section on page 39, 7 personal rewards and 3 social rewards have been identified by those who participate in a serious leisure activity. By once more adapting the definitions of these rewards (Stebbins, 2007) to astrocasting in particular, the following are obtained:

Personal rewards from Astrocasting

1. Personal enrichment (cherished experiences while astrocasting).
2. Self-actualization (developing skills, abilities, knowledge in astronomy and astrocasting).
3. Self-expression (expressing skills, knowledge already developed in astrocasting).
4. Self-image (known to others as a particular kind of astrocaster).
5. Self-gratification (combination of superficial enjoyment and deep fulfillment while astrocasting).

6. Re-creation (regeneration) of oneself through astrocasting after a day's work.
7. Absence of or lack of significant financial return (from astrocasting).

Social rewards from Astrocasting

1. Social attraction (associating with other astrocasters and with viewers in a social media environment).
2. Group accomplishment (group effort in accomplishing astrocasting; sense of helping others or being needed to succeed at astrocasting).
3. Contribution to the maintenance and development of the astrocasting community (participating regularly in astrocasting and helping improve the experience for all).

These 10 rewards dovetail well with the idea expressed in the Social Media section of this chapter on page 60 of not letting a steep learning curve and initial financial investment in astronomy prevent the viewers from enjoying the fruits of the astrocasters' endeavours.

4.2.4 The Serious Leisure Inventory and Measure

The rewards described above, along with the idea of longevity expressed with the six distinguishing qualities of astrocasting, form the basis of the determination of astrocasting as a serious leisure activity among its participants. For this purpose, the Serious Leisure Inventory and Measure can be used for a quantitative test of Hypothesis H_1.

In 2008, Gould, Moore, McGuire, and Stebbins described the development and successful testing of the Serious Leisure Inventory and Measure (SLIM) that can be used to deter-

mine quantitatively if a sample population considers any given leisure activity as a serious leisure activity or not. Its creation involved the self-reporting of volunteers on their leisure activities, an expert panel, and a confirmatory factor analysis to arrive at a 72-item questionnaire "that demonstrated an acceptable fit, reliability, and equivalence across samples" (Gould, Moore, McGuire, & Stebbins, 2008, p. 47). A 54-item short-form of the SLIM instrument also demonstrated good model fit and construct validity.

The development of the SLIM used both convenience and target samples and quantitatively measured 18 different factors inductively derived from distinguishing qualities and rewards (both personal and social) that typify any serious leisure activity, as mentioned in the previous 2 sections (4.2.2 and 4.2.3). These factors are as follows:

1. Perseverance (PS)
2. Effort (EF)
3. Career progress (CP)
4. Career contingencies (CC)
5. Personal enrichment (PE)
6. Self-actualization (SA)
7. Self-expression of abilities (SEA)
8. Self-expression as an individual (SEI)
9. Self-image (SI)
10. Self-gratification by satisfaction (SGS)
11. Self-gratification by enjoyment (SGE)
12. Re-creation (RC)
13. Financial return (FR)
14. Group attraction (GAT)
15. Group accomplishments (GAC)
16. Group maintenance (GMA)
17. Unique ethos (UE)
18. Identity (IDE)

The questions of the 54-item short-form questionnaire, adapted to specify astrocasting as the leisure activity under study, can therefore allow for the quantitative determination of astrocasting as a serious leisure activity or not. The details of the administration of this test are described in the Methodology section.

4.3 Self-Determination Theory of Motivation in Astrocasting.

4.3.1 Who Tells Them to do it?

As explored in the Motivational Models section of the Literature Research chapter, it was determined that the Self-Determination Theory of Motivation, as put forward by Deci and Ryan (Deci & Ryan, 1985), is the perspective that is best suited to the exploration of leisure activities. Indeed, as Deci and Ryan adequately put it, "Self-Determination Theory

focuses on the dialectic between the active, growth-oriented human organism and social contexts that either support or undermine people's attempts to master and integrate their experiences into a coherent sense of self" (Deci & Ryan, 2002, p. 27). Put simply, it is the glue that binds the Social Media and Serious Leisure aspects of this research project.

A definition of motivation by Legendre (2005, p. 917) within this perspective was described earlier on page 47. By adapting it to the astrocasting universe, the following definition of motivation is obtained:

Definition 7

Motivation is a hypothetical construct used to describe internal and/or external forces producing the triggering, direction, intensity, and persistence of the observed behaviour, (namely, astrocasting).

However, the approach taken within the Self-Determination Theory (SDT) of motivation "... is based on the assumption that people are naturally inclined to integrate their ongoing experiences..." (Ryan & Deci, 2002, p. 15). Therefore, the definition of motivation can vary depending on whether it is external or internal for a given individual, as it is based on his or her individual " ... capacity to choose and to have those choices, rather than reinforcement contingencies, drives, or any other forces or pressure, be the determinants of one's actions" (Deci & Ryan, 1985, p. 38).

Taking the above into account, the question of what motivates astrocasters therefore becomes one based on the level of internalization, or freedom of choice of the individual, in

undertaking their activity of choice.

4.3.2 Me, You, or Nobody?

According to SDT, there are different types of motivation that distinguish themselves by the level of self-determination that underlies the behaviour (Pelletier L. G., Vallerand, Green-Demers, Brière, & Blais, 1995, p. 142): intrinsic motivation, extrinsic motivation, and amotivation. Restating these definitions in terms of astrocasting as the activity under study yields the following three definitions:

Definition 8

Intrinsic motivation (IM) is the motivation to engage in astrocasting for the pleasure and satisfaction inherent in the activity.

Definition 9

Extrinsic motivation (EM) is the motivation to engage in astrocasting for reasons not inherent in the activity.

Definition 10

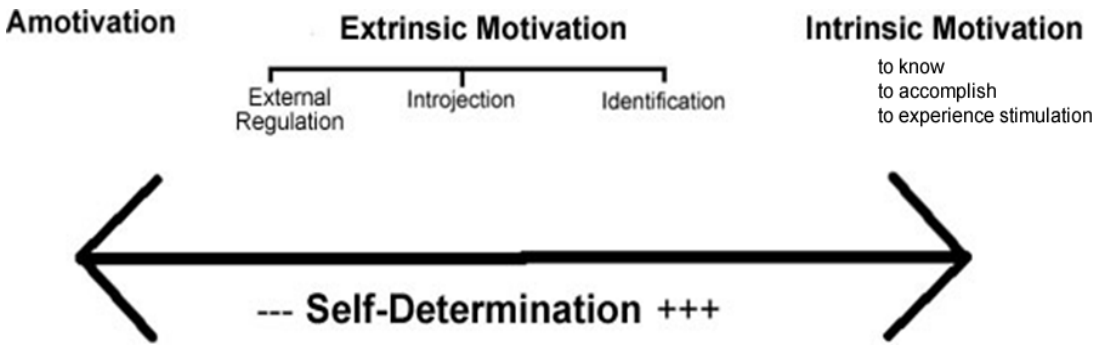
Amotivation (AM) is an absence of motivation in astrocasting.

Pelletier *et al*. explain how these three definitions interact with each other: "According to Deci and Ryan (1985), the different types of motivation (...) can be placed on a continuum depending on their level of self-determination. Intrinsic motivation, because it underlies the behaviours that are triggered freely and for pleasure, represents the highest level of self-

determination. Amotivation represents the type of motivation that is least self-determined since it represents an absence of control. The different types of extrinsic motivation are placed between these opposite poles" (Pelletier L. G., Vallerand, Green-Demers, Brière, & Blais, 1995, p. 144).

As discussed previously in section 3.3.6 on the Self-Determination Theory of Motivation on page 47, The Self-Determination Continuum can be graphically represented, as shown in Figure 27. Illustration of the Self-Determination Continuum, adapted from Legendre Figure 27 below.

Figure 27. Illustration of the Self-Determination Continuum, adapted from Legendre (Legendre, 2005, p. 917).



Within the SDT, and as shown in the above figure, extrinsic motivation is divided into three sub-types: EM by external regulation, EM by introjection regulation, and EM by regulation through identification. Adapting for astrocasting the definitions of these terms by Pelletier *et al.* (1995, p. 142), the following are obtained:

- **EM by external regulation (EM-ER):** It is the least autonomous form of extrinsic motivation towards astrocasting and includes the classic instance of being motivated to obtain rewards or avoid punishments.
- **EM by introjection regulation (EM-IR):** It involves an external regulation towards astrocasting that has been somewhat internalized, but not, in a much deeper sense, truly accepted as one's own.
- **EM by regulation through identification (EM-ID):** It is a more self-determined form of extrinsic motivation towards astrocasting, for it involves a conscious valuing of astrocasting, an acceptance of astrocasting as personally important.

There are also three types of intrinsic motivation, but contrary to the sub-types of extrinsic motivation, they are all equivalent. Adapting these definitions from Ryan and Deci (2002, p. 17) for astrocasting, the following are obtained:

- **IM to know (IM-K):** A person is intrinsically motivated to know when he or she is engaged in astrocasting for the pleasure felt when learning something new.
- **IM to accomplish (IM-A):** A person is intrinsically motivated to accomplish when he or she is engaged in astrocasting for the pleasure of feeling efficient and competent.
- **IM to experience stimulation (IM-S):** A person is intrinsically motivated to experience stimulation when he or she is engaged in astrocasting for the purpose of the special feelings it provides.

4.3.3 So, Who is it?

Considering the above exploration of the Self-Determination Theory of Motivation, the question of what motivates astrocasters to do what they do becomes one where the level of internalization of astrocasting needs to be determined. Taking the view that astrocasters do it because they choose to, the following hypothesis can be postulated:

Hypothesis H_2

Those who partake in astrocasting are intrinsically motivated to do so.

4.3.4 The Leisure Motivation Scale (LMS)

The SDT has the advantage that all forms of motivation within this perspective lie on a continuum. The testing of Hypothesis H_2 therefore becomes a determination of where the motivation for astrocasters can be found on this scale. For this purpose, a tool has been developed specifically for leisure activities: the Leisure Motivation Scale (LMS).

The LMS was created by Pelletier *et al.* by constructing seven sub-scales for each form of motivation (amotivation, the three forms of extrinsic motivation, and the three forms of intrinsic motivation) that were operationalized using statements on leisure activities that were linked to each one of them by a sample population (Pelletier L. , Vallerand, Green-Demers, Blais, & Brière, 1996, p. 566). Initially composed of 70 questions, it was reduced to 28 after the results were analyzed. The validity of the test was then established by measuring the internal coherence of these sub-scales to confirm that the items which form the sub-scales were homogenous, by confirmatory factor analysis to check that the test does indeed correspond to the theoretical construct of the SDT (i.e. the motivation scale), and by ensur-

ing that the LMS was indeed temporally reliable (i.e. that the test results would be repeatable).

As a result of its extensive testing, the LMS can be used test Hypothesis H_2 by determining quantitatively the type of motivation of a sample population towards astrocasting as a leisure activity. If this hypothesis is confirmed, an interesting by-product of the measurement of the level of internalization of astrocasting would be the ranking of the sub-types of intrinsic motivation. In other words, in what order would the intrinsic motivation sub-types appear in the sample population (IM to know, IM to accomplish, and IM to experience stimulation)?

The details of its administration of the LMS are described later in the Methodology section.

4.4 The Research Question

For this research, it is proposed that astrocasting be studied in a three-pronged approach: the further exploration of the Night Skies Network site as a Social Media site; hypothesizing that astrocasting is a serious leisure activity under the Serious Leisure Perspective; and hypothesizing that individuals who partake in astrocasting are intrinsically motivated to do so.

From this section, a global question for this project arises:

Within a Social Media environment, are those who undertake astrocasting as a Serious Leisure activity intrinsically motivated to do so?

As astrocasting is an emerging phenomenon, no prior studies have ever been made on it, either in a Social Media perspective, a classification of the type of leisure activity, or a study of the motivation of the participants. As the two hypotheses are tested and further explored within the same theoretical framework, an added richness in the results can therefore be obtained, as an increased understanding on the beginning of the Night Skies Network Social Media site can shed light on other similar sites from perspectives not usually associated with the field of Communication. Furthermore, additional research using the quantitative measurements of various factors from the Serious Leisure and the Self-Determination perspectives can later be done using the raw data acquired; however, this lies beyond the scope of this endeavour.

The following section, Methodology, will map out how the global question will be addressed.

5. Methodology

This chapter describes the methodologies used to a) quantitatively test both hypotheses H_1 and H_2, b) explore the phenomenon of astrocasting qualitatively, and c) recruit a sample population from the general astrocasting community. The methodology described in this section received an Ethics Approval Notice by the University of Ottawa's Research Grants and Ethics Services, file number 09-09-08.

5.1 A Question of Difficulty

The exploration of astrocasting as a Social Media phenomenon has never been attempted before, due to the fact that it is barely emerging on the Internet. However, as mentioned in section 4.1.5 of the Theoretical Framework on page 60, the questions that needed exploring were related to the learning curve and other difficulties that had to be surmounted in order to succeed at astrocasting. Since the creation of a questionnaire that would quantitatively measure these aspects would be another research project in itself, and as the questions to be explored were open-ended, an open-ended qualitative exploration of astrocasting as a Social Media phenomenon was proposed.

A fortunate aspect of the geographical distribution of astrocasters was used advantageously for this qualitative exploration The Ottawa Valley Astronomy and Observers Group (OAOG), which meets once a month at a local coffee shop, and of which Mallin is a founding member (OAOG, 2001), has a sizeable number of astrocasters. Therefore, an exploratory focus group composed of astrocasters who live in the Ottawa region was held in order to

give some perspective on the positive results from the testing of H_1 and H_2.

The 10-item interview guide, found in Appendix C, has been composed with open-ended questions to allow for the exploration of aspects related to the learning curve and other difficulties associated with astrocasting.

5.2 A Question of Seriousness

Hypothesis H_1 was formulated at after the Serious Leisure Perspective was explored in relation to astrocasting:

Hypothesis H_1

> *The population studied considers astrocasting as a serious leisure activity.*

When the Serious Leisure Inventory and Measure was constructed, it was composed of 72 questions which measure four times each of the eighteen different factors mentioned in the Theoretical Framework chapter. The questions are answerable via a nine-point Likert response scale (from 0 for "Completely Disagree" to 8 for "Completely Agree").

Since the 54-item short-form of the SLIM shows good fit as well (3 questions per factor), and because the SLIM forms only part of the final questionnaire that the sample population has to answer, it was used in the interest of minimizing the time spent answering all the questions, thus preventing boredom and the submission of non-completed questionnaires on the part of the participants.

H_1 was therefore quantitatively tested with the SLIM by measuring the adherence of the sample towards astrocasting as a serious leisure activity, and the results compared with published expected values (Gould, Moore, McGuire, & Stebbins, 2008) using a chi-square goodness of fit test.[3] Since it is a non-parametric test, it must conform to the following 2 assumptions in order to be valid:

1. That the population sample is randomly selected from the studied population; and
2. That the observations be independent of one other.

As mentioned in the recruitment section later on in this chapter, the first assumption was not completely achieved, as the sample population was one of convenience. This limited the extrapolation of the results solely to the population of astrocasters.

5.3 A Question of Motivation

Astronomy, in general, has a steep learning curve. In the case of astrocasting, however, the learning process is more arduous due to the operation of the Mallincam. This implies that astrocasting individuals have to be highly motivated. Fortunately, this can be determined quantitatively within the sample population using the Leisure Motivation Scale (LMS) (Pelletier L. G., Vallerand, Brière, & Blais, 1989). The result of this test can reveal if the sample population is amotivated, extrinsically motivated, or intrinsically motivated.

Given the nature of astrocasting and the fact that the phenomenon studied is at its beginnings, it is expected that the sample population is intrinsically motivated, as explored earlier

[3] The chi-squared (X^2) goodness-of-fit test is used to compare the results obtained to the expected values (those obtained when the SLIM instrument was created).

in the Theoretical Framework chapter. Here is Hypothesis H_2 again:

Hypothesis H_2

Those who partake in astrocasting are intrinsically motivated to do so.

The LMS test quantifies each type of motivation 4 times via a 28-item questionnaire answerable by a seven-point Likert response scale (from 1 for "Does Not Correspond At All" to 7 for "Corresponds Exactly"), allowing for the measurement of the attitudes of the sample population towards all forms of motivation within Self-Determination Theory (from amotivation to intrinsic motivation). A hierarchical analysis of variance (ANOVA) was then used to test for variation among the forms of motivation within the sampled population as a preliminary analysis to confirm the independence of the responses for each category before using the results for analysis.

Given H_2, the following was expected: low levels of amotivation (A), high levels of intrinsic motivation (IM), and mid-levels for extrinsic motivation (EM). There is also a subscale within extrinsic motivation, (in increasing order, from external regulation (ER), to introjection regulation (IR), and then to regulation through identification (ID)). The highest measured sub-level of extrinsic motivation was therefore expected to be that for regulation from identification.

The hierarchical ANOVA rests upon certain assumptions for its validity:

1. that the population sample is randomly selected from the studied population;

2. that the observations be independent of one another;
3. that the sample comes from a population with a normal distribution; and
4. that the residuals are homoscedastic (i.e. that the error terms in the ANOVA model are equal).

As for H_1, the first assumption was not completely achieved, as the sample population is one of convenience.

Finally, quantifying the motivation of the group of astrocasters requires that the population studied see astrocasting as a serious leisure activity. This condition has been met, as H_1 was confirmed. Otherwise, the result of the motivation test would have more closely reflected the motivation levels of the general population, including those individuals who see astrocasting as a project-based leisure activity or even casual leisure activity.

5.4 Operationalization of the Research Methodology

This section describes the recruitment process of a sample population of astrocasters from within the general astrocasting population, the method of exploration of astrocasting as a Social Media phenomenon, and the testing methods used to validate or invalidate hypotheses H_1 and H_2.

5.4.1 Focus Group

5.4.1.1 Recruitment of a Sample Population for the Focus Group

The astrocasting phenomenon studied traces its origins to the Ottawa region, as the builder of the cameras used in most astrocasting activities lives and works there. As well, the local group of active amateur astronomers, the Ottawa Astronomy and Observers Group (OAOG), has a significant number of astrocasters in its membership; this is not surprising since Mallin sold his first cameras to local amateur astronomers in his region. It therefore made sense to recruit a local population for the Focus Group, for temporal and geographical reasons.

To ensure that most of the local astrocasters were reached, a recruitment letter (Appendix A) was sent on four separate occasions on the following four discussion fora:

- Cloudy Nights (http://www.cloudynights.com);
- Videoastro (http://tech.yahoo.con/group/videoastro);
- Mallincam (http://tech.yahoo.com/group/mallincam); and
- OAOG (http://tech.yahoo.com/group/oaog).

The eight individuals who responded via e-mail were informed of the two dates that the Focus Group would be held and the location, a local coffee shop (Tim Hortons, at 2800 Lancaster Road, Ottawa, ON, K1B 4S4). The location chosen was the same one where the OAOG members meet regularly to facilitate access to all.

5.4.1.2 Conduct of the Focus Group Meetings

At the first of the two focus group meetings, the eight participants were required to sign two copies of a consent form (Appendix B) mandated by the University of Ottawa's Office for Ethics in Research; one copy was kept by the researcher, and the other provided to each participant.

The focus group was conducted in two 90-minute sessions, using the interview guide found in Appendix C. An open format was used to permit participants to elaborate on related points brought up and to explore avenues not considered when the questionnaire was designed.

Both sessions were recorded with a Zoom H2 Personal Recorder, and the relevant points transcribed at a later date.

5.4.2 On-Line Questionnaire

5.4.2.1 Recruitment of the Sample Population for the On-Line Questionnaire

Astrocasting, as an emerging phenomenon, imposes some difficulties in its in-depth exploration, as the population to be studied is intrinsically small. The location of "shared connections" (boyd [*sic*] & Ellison, 2008, p. 211), or nexuses, to locate as many astrocasters as possible is therefore of paramount importance.

The Mallincam discussion group on Yahoo!, having acted as the starting point and incubator for this phenomenon, provided fertile grounds for this study, as this segment of the population already had a "shared connection": that is, ownership of a Mallincam. This was

used as a discriminating factor when recruiting (as imposed by Definition 1), thus eliminating any variance that could have been caused by the ownership of other products that are used in astrocasting.

To ensure that the largest number of astrocasters was reached, a recruitment letter (Appendix D) was sent four separate times on the following four discussion fora:

- Cloudy Nights (http://www.cloudynights.com);
- Videoastro (http://tech.yahoo.con/group/videoastro);
- Mallincam (http://tech.yahoo.com/group/mallincam); and
- OAOG (http://tech.yahoo.com/group/oaog).

As the sample recruited was one of convenience, the interpretation of the results had to take into account the fact that it was not randomly selected from the general population, as it was one of the assumptions upon which the testing of H_1 and H_2 was based upon. The effects this has had on the validity of the results will be discussed later in the Discussion chapter.

5.4.2.2 Administration of the On-Line Questionnaire

The twenty individuals who responded via e-mail were each given a unique Web address that led them to the on-line survey service "Survey Monkey" (http://www.surveymonkey.com). There, the consent form found in Appendix E was agreed upon by them via a checkbox before proceeding. They then answered some socio-demographic questions (Appendix F) to obtain some non-identifying information to help characterize the population taking the survey, and to ensure that they did astrocasting as a hobby, and not as an income activity, as mentioned in section 4.2 on page 62. Finally, they

were led to the first page of the on-line questionnaire. Of note is the fact that all 20 participants completed the questionnaire.

The first 54 questions consisted of the short-form of the Serious Leisure Inventory and Measure (SLIM, Appendix G), chosen over the 72-item long-form to minimize the time spent completing the questionnaire. They were randomized and set on six-consecutive pages. Participants answered each question by checking a radio button corresponding to their answer on the 9-item Likert scale (from "Completely Disagree" to "Completely Agree"). Each page had to be filled before continuing to the next one.

After answering the last question of the SLIM, participants then proceeded to the 28-item Leisure Motivation Scale (LMS, Appendix H). They were randomized and set on four consecutive pages. Participants answered each question by checking a radio button corresponding to their answer on the seven-item Likert scale (from "Does not correspond at all" to "Corresponds exactly"). Each page had to be filled before continuing to the next one.

After completing both questionnaires, the participants arrived at a page which thanked them for their participation in the research project.

When the six week deadline for completing the questionnaires had passed, the results were later compiled and retrieved (in Microsoft Excel format) from the Survey Monkey online survey service.

6. Results

6.1 Results of the Focus Group

6.1.1 Socio-Demographic Data

The focus group was composed of 8 participants, all from the Ottawa, Ontario area, and met twice (each session lasted 90 minutes) in January 2010 at a local coffee shop. The ratio of males to females was 7 to 1, and their ages varied between 39 and 69 years, the average age being 50.3 years. All of the participants had graduated from high school, and 7 had gone to do post-secondary studies, with one of them having completed a Master's degree.

6.1.2 The Beginnings of Astrocasting

Three developments were identified in the Theoretical Framework chapter on page 51 as having made astrocasting possible. The responses of the focus group discussions on each one of them are described below.

6.1.2.1 Telescopes

The easy availability and affordability of telescopes, and their computerized brethren later on, was mentioned as both a limitation in the participants' early involvement in astronomy as well as a source of amazement. When the question "What attracts you to astronomy?" was asked, 7 out of 8 participants in the focus group session described their introduction to the leisure activity; 2 of them talked about going to the library to satisfy their curiosity, 3 about their complete lack of access to a telescope, one on having to go to a professional observatory, and the last on the cheap department-store telescope that he bought. Of note is the fact

that all of them stated that their interest started very young (before 12 years old), with all of them having started in astronomy well before the advent of affordable computerized telescopes.

In the interval between their introduction to astronomy and the first focus group meeting, all of the participants had acquired good-quality telescopes, of which 7 out of 8 were computerized.[4] The obstacle to finding what they wanted in the skies was therefore removed entirely compared to when they all began.

However, one problem remained: if they wanted to do astronomical observations with a telescope, the only way that this could be achieved was to stand at the eyepiece of the telescope if they wanted a live view.[5] This tyranny of locality with respect to access to astronomical equipment was made abundantly clear by the descriptions of how the participants got started in astronomy. Furthermore, this problem got multiplied by the number of persons wanting to look through the same telescope if they were not alone, as only one person at a time could look through the eyepiece.

The participants mentioned that the instrumental limitations of telescopic observations before the Mallincam prevented the hobby of astronomy from being enjoyed by a wider audience, as the live views through a telescope could not be easily shared. In short, with respect to sharing the same photons of light, it was a lonely hobby.

[4] These "GoTo" telescopes greatly facilitate the location of a desired object in the sky. Their initial alignment procedures involve having to tell them the location of two stars in the sky; afterwards, they can go to any coordinates in the sky as they have mapped it using these reference points and their databases of objects.

[5] Otherwise, they could also appreciate still images taken with telescopes from their homes.

6.1.2.2 Mallincam

The development of the Mallincam in 2002 was viewed as a watershed moment by the participants in the focus group; they describe their first experiences with a Mallincam as being immediately gratifying. Here are a few quotes from the focus group describing their impressions.

> *"The power of (the Mallincam) is the near-instantaneous reward you get. You're able to see things that with the naked eye you couldn't see. And it's very rewarding. And it's near picture quality, it's stuff that used to be printed into books, and now you're doing it with your telescope, you can actually see it live on the screen." – Session 1, Male Participant #7, 45-54 years old.*

> *"What I'm doing now (with the Mallincam) is visual supernova search. There's a database of photos. I have one computer on with the photo, and the other with a Mallincam image of the galaxy, and you can easily do 30 within a night." – Session 1, Male Participant #4, 45-54 years old.*

One of the participants even went so far as to bring his entire setup in a parking lot of a commercial centre during Astronomy Day 2008.[6]

> *"They were watching a 32" TV that he ripped out of his wall unit at home and installed on top of his van, and he was able to point out on his screen what we were looking at (with the*

[6] Astronomy Day is an international event organized by local astronomy clubs around the world to share their enjoyment of astronomy with the public.

Mallincam attached to his telescope).” – Session 1, Male Participant #5, 45-54 years old.

This example aptly describes what went on many times during that evening: members of the public kept crowding around a television to look at the object being viewed with a Mallincam. This situation exemplifies the removal of the requirement for each individual to stand in line and individually view the selected target through the telescope’s eyepiece; the viewers could all see at the same time the telescope’s target and get a common description of it from the amateur. However, the viewers still had to stand next to the monitor displaying the live image.

At this point the focus group participants all agreed that the Mallincam had created possibilities in terms of public outreach, the strong point being that the telescope’s target could be displayed on a regular television screen or on a computer monitor where many people could be watching at the same time. However, as the next section demonstrates, it took a third element to get rid completely of the limitation imposed by having to stand next to the monitor to participate in the observations, thus allowing astrocasting to grow into the phenomenon that it is today.

6.1.2.3 Free Internet Streaming

All the participants agreed, at this point, that they would not have been as enthusiastic as they are now if it wasn’t for the availability of a Web site that allowed for the free streaming of observations being done with a Mallincam attached to a telescope. Indeed, some mentioned the Cosmocasts (Astrochannels, 2006), described in section 1.3 on page 6, as an ini-

tial deterrent to astrocasting, as they asked the viewers for contributions to help with the expenses related to streaming their video feed on the Internet from remote locations. This attempt to change the business model from a free one (the Freemium model) to a voluntary contribution model for the viewers, along with the fact that nobody else but the Web site owner could log on to share the video feeds, did not go well for the Cosmocasts, as they were never heard from again after 2007.

When asked if they would continue astrocasting in the future, and for how long, all the participants said that they would continue to engage in it as long as they could, but only if the site they were using on the Internet remained freely available. The related remarks all went along the lines of them being grateful for the sponsorship by a commercial entity of the NightSkiesNetwork.com site, as it permitted them to continue astrocasting from a common Internet location. Otherwise, the absence of a social media site that was based on the Freemium model and that was specifically devoted to astrocasting would severely limit the participants' options to continue to partake in astrocasting.

Other factors that were mentioned for remaining with NightSkiesNetwork.com were the collegiality among astrocasters. When this was raised in the first meeting, someone described the following event where this was made abundantly obvious.

One night, an amateur astronomer was astrocasting from his home in Europe, and was asking for a target to test the capabilities of his telescope and the attached Mallincam. One of the participants was viewing this session from Ottawa, and suggested Hickson 50, a cluster of very faint galaxies in the constellation of Ursa Major. The European astrocaster indicated

that he didn't know how to get there, and that his telescope's database didn't contain the coordinates for this target. The participant described what happened next:

> *"Basically, he didn't know where to go… I was here in Ottawa, and as soon I found out exactly where he was in the sky, then I was able to guide him through the stars. It took about 15 minutes and I said that it's not visible with (his current Mallincam settings), but it should be there. (He adjusted the settings to) put the camera on full blast, and 15 seconds later, there's Hickson 50 on my screen, and in colour. And I've never met the guy face-to-face. And while doing this, we were chatting all the time." – Session 1, Male Participant #6, 35-44 years old.*

This occurrence, where a viewer from Ottawa was able to guide an astrocaster from Europe and could see where he was pointing his telescope live on his screen, was also being viewed from another focus group participant. He described how he got to experience the same event:

> *"I think it would have been with Yahoo! Live, I can't remember when it started, but I remember the most memorable part. That was when (the participant from the previous example) was helping the European astrocaster across the world to find (his target)... (I heard him say) "Turn here, to your right, turn left, and it's there. Set this, set that." And I remember I was sitting in my La-Z-Boy chair, in the living room, going "this is nuts." – Session 1, Male Participant #3, 45-54 years old.*

In addition, the Ottawa participant who helped the European astrocaster find the desired target showed that user-generated content for NightSkiesNetwork.com was not limited to the astrocaster, but was indeed available to all who were connected. In essence, these astrocasting sessions are no longer broadcasting sessions, but multicasting sessions as well.

One participant then let his imagination go free to see how else astrocasting could be used around the world:

> *"Imagine having two schools, one in Australia, and one up here somewhere in the Ottawa area, both doing astronomy. And classes act as tour guides for the heavens for each other. The kids here, when it's their turn to broadcast, the teacher would get into exploring the Dumbbell Nebula, or the Ring Nebula. The thing is you can only see (them) from the Northern Hemisphere, which they've seen in books, but have never had a chance to see. Whereas the kids in Australia, when it's their turn, will be teaching our kids about the Large and Small Magellanic clouds. So, you know, (...) through astrocasting and through the Web, (...) they get to explore and exchange information on what they've discovered, what they've seen." – Session 2, Male Participant #1, 45-54 years old.*

This type of situation occurred, but on a much smaller scale, as one focus group member described:

> *"One of the first times that I was astrocasting, it was a Saturday night, and while I was live at the time, (a viewer) and his daughter in Malaysia were on, and I was showing them our*

> *(northern) objects. It was our evening and daytime for him* [*sic*]. *The next morning, he was astrocasting at his end, and I was showing my daughter his stuff that he was showing; it was day for us and night for him* [*sic*]*." – Session 1, Male Participant #6, 35-44 years old.*

Another participant chimed in at this point with the following:

> *"A guy in Australia did that. For the longest time, when we had Yahoo! Live, I would go to work at 8:30 in the morning, I would sit down, have my coffee, and he's at night, and he was showing his sky." – Session 1, Male Participant #3, 45-54 years old.*

For all intents and purposes, the focus group was providing examples of the answers to another question, "What is the key element that convinced you to do astrocasting?" All the answers varied over the same theme of wanting to share observations for various reasons, be it for public outreach or for the simple pleasure of wanting to share their observations. One participant also said that astrocasting allowed him to share his personal curiosity of the skies with all who wanted to accompany him. Asked about the number of viewers they had on their channels, most said about 30 were on-line at any given time, with one saying that he regularly got over 60, adding that he thought that he once had close to 100 when the NightSkiesNetwork.com site went down.

6.1.3 The Learning Curve

When the group was then asked about when they first heard of astrocasting, the various Internet discussion groups that were consulted to locate participants for this research project were mentioned. Their interest was further stoked when they saw a description of one astrocasting session of a lunar eclipse on the Mallincam discussion group on Yahoo! (Mallin, 2008). This event quickly led some participants to try their hand at it themselves, as demonstrated by the following three quotes.

> *"(A participant) made an interesting point about when you see something that somebody else is broadcasting. You say "Hey! I'm going to make a note. I'm going to capture that, and I want to see it, and then I'll broadcast it next time* [*sic*]*. It gives you an idea of what's out there, what's interesting and what you haven't seen yet, and if you liked it." Session 2, Male Participant #7, 45-54 years old.*

> *"It's the same thing when we get together, out there in the field. Somebody says "I'm looking at this" and you look, and say "Oh, I'm gonna do it too!* [*sic*]*" And then everyone is looking at the same thing!" Session 2, Male Participant #3, 45-54 years old.*

> *"Why do you think (the European astrocaster) ended up astrocasting Hickson 50? Because he heard us talk about it on the night before. He wanted to try it out, he did, and it worked." Session 2, Male Participant #6, 35-44 years old.*

These three interventions demonstrate that the community of astrocasters feeds on itself to test its astrocasting setups to their limits, and lead to an interesting question: are the astrocasters targeting the same objects for the purpose of the special feeling it provides, or are they doing it because others do it? The first reason would relate directly to a form of intrinsic motivation (Intrinsic Motivation to Experience Stimulation, or IM-S), which means that the drive to experience the same special feeling comes from inside the individuals. The second would correspond to an extrinsic source for the motivation (Extrinsic Motivation by Regulation through Identification, or EM-ID), suggesting that the astrocasters replicate the results amongst them to "belong" to the group. While the focus group did not remain any longer on this point, further exploration might not have provided an answer; the quantitative measurement (in the on-line questionnaire, see section 6.2.3.2 on page 112) of the two types of motivation mentioned above also shows ambiguity.

The focus group then turned to the difficulties encountered with astrocasting, when all expressed some frustrations about the technical difficulties that they had to surmount.

A list of hurdles was then quickly produced, and included the following elements:

- Software;
- Computer hardware;
- High-speed Internet access; and
- Operation of the Mallincam.

6.1.3.1 Software

Many sites that offered free broadcasting on the Internet were tried before astrocasting converged to NightSkiesNetwork.com, namely a) Yahoo! Live (live.yahoo.com), b) Ustream.tv, c) Sparkcast.com, d) ZapLive.tv, e) Justin.tv, and f) Livestream.com. The participants described the difficulties in adapting to the peculiarities of each broadcast service, making it difficult for the astrocasters to help each other out on the discussion groups. Therefore, no consistent method or set of instructions could be shared to ease the learning curve for those attempting to do astrocasting for the first time.

The establishment of the NightSkiesNetwork.com site in November 2009 was viewed as a relief from the participants, as they could then help each other on a common software platform. The principal means for exchanging information that was identified was the logging on a channel as a viewer and ask questions as to how fellow astrocasters have configured their setup. Other resources identified were the Mallincam discussion list and the Ottawa Valley Astronomy and Observers' Group (OAOG) discussion list, both on Yahoo! Groups.

Another means of troubleshooting for each other is to be physically present when an astrocasting session occurs. This was not surprising because the Mallincam was invented in Ottawa, and that many in the OAOG were among the first to purchase one in 2002. The participants cited the close proximity of fellow astrocasters as an important factor that made the informal transfer of knowledge much easier, as they were able to see what software settings were being used on his or her computer.

It is interesting, at this point, to remark that despite the exchanges in the chat window of an astrocasting channel (see Figure 24 on page 55) or in the various discussion groups on the Internet, some participants nonetheless preferred to be physically present at the computer from which these sessions were originating. The reason given by them during the meeting is because they don't see the software settings on the screen when watching an astrocast, information which they can only gather by asking for it on the discussion groups or from the astrocaster via the chat window while viewing a session.

6.1.3.2 Computer Hardware

All participants noted this obstacle when configuring their computers to use the video capture device required to do live astrocasting. As one put it,

> *"I went through a (great number) of computers to find out which one works or not." – Session 1, Male Participant #5, 45-54 years old.*

And another noted that his computer had a major hardware failure in the middle of an all-night astrocasting session.

All agreed, at this point, that a computer has to be powerful enough to handle a video input and the multimedia platform on NightSkiesNetwork.com to make an astrocasting session flow easily.

6.1.3.3 High-Speed Internet Access

All agreed that an Internet connection has to be of optimal speed to either transmit or receive the astrocasting session. One participant jumped in and reminded the others that he could only do astrocasting sessions from elsewhere than his home because he was still using dial-up access (56kbits/s). Another participant then described his adamant opposition from having a high-speed connection at home; he gave in and had it installed after he discovered that astrocasting sessions tended to fail very badly when using dial-up only.

In short, astrocasting could not have blossomed into the on-line phenomenon that it is today without the availability of high-speed Internet connections

6.1.3.4 Operation of the Mallincam

The focus group's comments on this subject went along the same lines as the comment below:

> *"If you know something about telescopes and have some background, not (necessarily an) extensive background, in a day or two, off you go." – Session 1, Male Participant #5, 45-54 years old.*

As in the case with software issues, the various discussion groups (Mallincam, OAOG, and NightSkiesNetwork.com) proved to be the most helpful in learning how to operate the Mallincam. Some commented on the fact that the camera models varied rapidly in time, but these concerns were allayed when one participant reminded everyone that the basic operation

of the Mallincam did not change much over the product's lifetime. The focus group then went on to other discussions.

6.1.4 Discussion

The focus group had discussions on the three important factors that were deemed essential in growing astrocasting into the Social Media phenomenon that it is today: 1) the availability and affordability of good quality telescopes, 2) the invention of the Mallincam, and 3) the availability of a high-speed connection to the Internet that enabled astrocasters to use a dedicated Social Media site (such as NightSkiesNetwork.com) for astrocasting. As the first two factors listed above became available, a form of tyranny of locality was removed (access to a telescope, access to a monitor that displayed the images acquired). The only requirement that was necessary for astrocasting for both the content providers and the consumers was access to the Internet. In short, the emergence of astrocasting as a Social Media phenomenon brought live astronomical observations to the global village.

This passion for a knowledge-intensive leisure activity proved useful for the participants, as they did not show any signs of discouragement when faced with the various obstacles inherent to astrocasting. They discussed having to deal with many learning curves simultaneously, namely software, computer hardware, Internet bandwidth, and the operation of the Mallincam itself. As well, the collegiality displayed by the participants has enabled them to share all their knowledge freely as soon as it was acquired; the focus group members mentioned that they did this to broaden the outreach possibilities of astrocasting.

Finally, the discussions about the targeting of the same astronomical objects for astro-casting has led to a related question: are the astrocasters doing this to experience the same feeling, or are they doing this to be "part of the group"? While a definite answer was not forthcoming from the participants, the results of the on-line questionnaire that relate to these possibilities also show that this question has no definite answer.

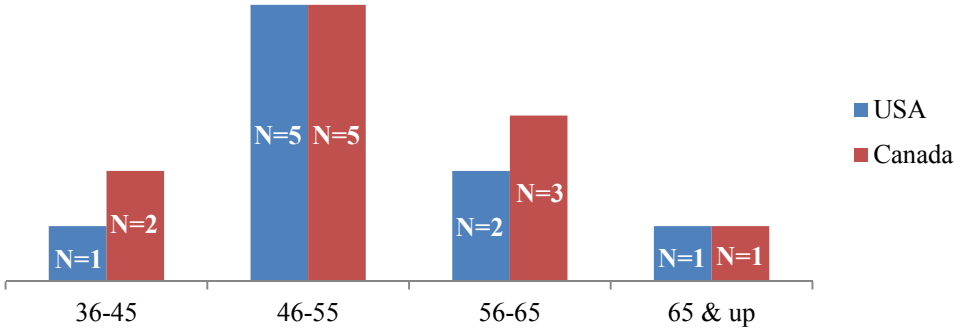
6.2 On-Line Questionnaires

6.2.1 Socio-Demographic Data

Of the 20 participants for the on-line questionnaire, all were male and owners of a Mallincam and the peripheral astronomical equipment. These participants represents 21.7% of astrocasters (N = 92) who had their own channel on the NightSkiesNetwork.com site (Turner, 2011). According to the age profile by country (Figure 1), the youngest participant was in the 36-45 age category.

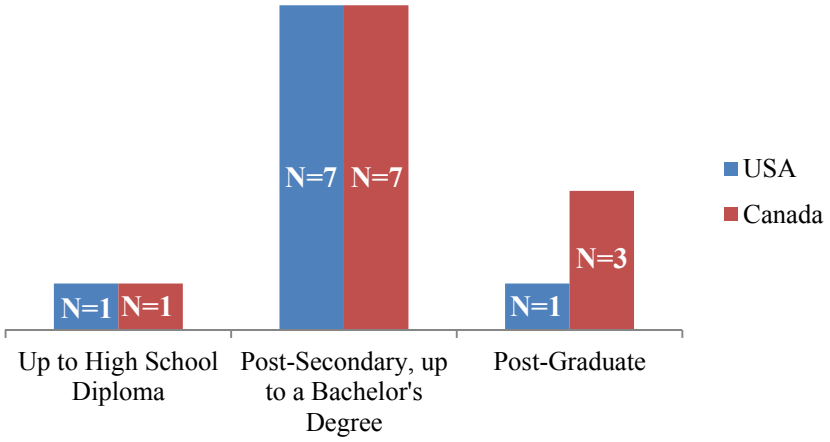
Furthermore, the sample was divided between Canadians (11 participants or 55 % of the sample) and the United States (9 participants or 45 % of the sample). In both cases, the largest age group was the 46-55 age group (5 Canadians and 5 Americans) followed by the 56-65 age group (3 Canadians and 2 Americans).

Figure 28. Age profile of the sample population of astrocasters, by country.



The educational profile of the sample population of astrocasters shows a high level of homogeneity, as shown in Figure 2. In our sample, the largest category was the "Post-Secondary, up to a Bachelor's Degree" for both Canadians (7 participants, or 63% of the sample) and Americans (7 participants, or 78% of the sample). [7]

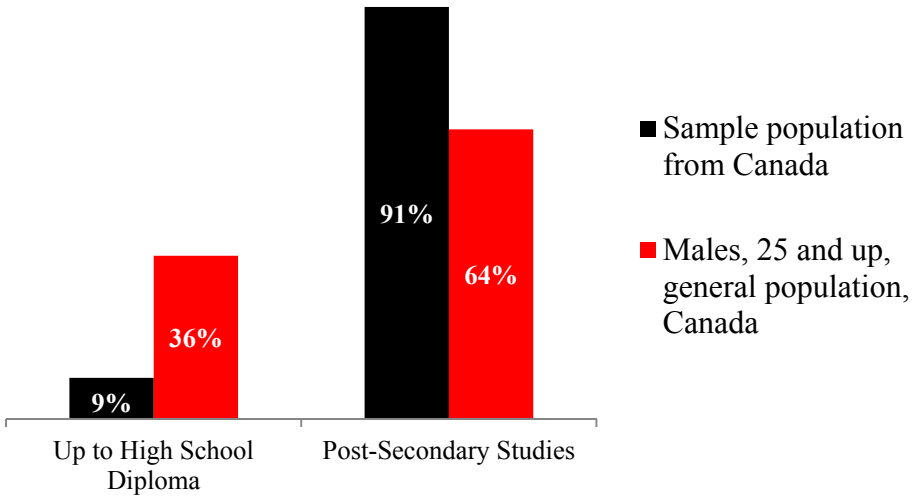
Figure 29. Educational profile of the sample population, by country.



[7] The college and bachelor's categories were combined because of the difference in the definition of college between Canada and the United States.

The representativeness of the sample population, in terms of education, is also similar in proportions for both Canadian participants and American participants when compared to the general populations of their respective countries. The proportion of Canadian participants (N = 10, or 91%) that did post-secondary studies is higher than the proportion of the Canadian general population that is over 25 years of age who did the same (64%, Figure 3).

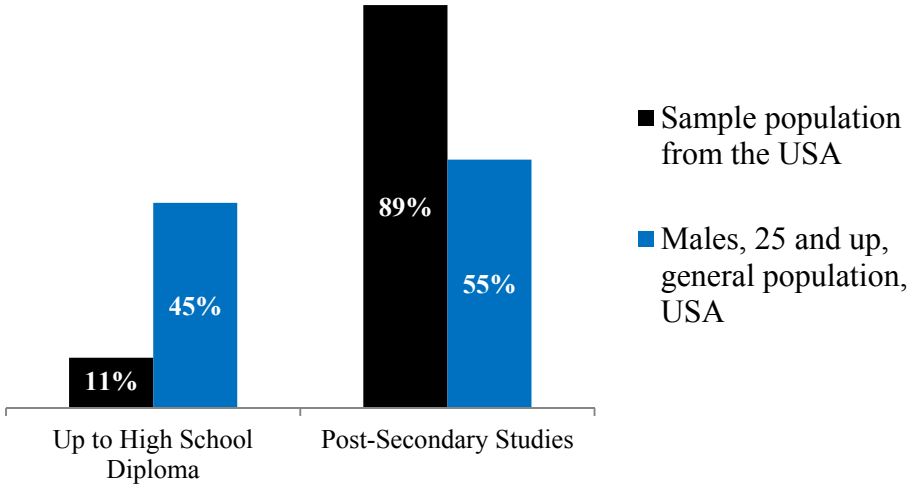
Figure 30. Educational profile of the sample population from Canada, compared to the general population aged 25 years and more (Statistics Canada, 2011).



Similarly, the proportion of American participants that did post-secondary studies (N = 8, or 89%) is also higher than the proportion of the American general population aged 25 years and more (55%, Figure 4) that did the same.[8]

[8] Statistics Canada's data did not have a category for people who are 35 years of age and older. Therefore, an age category common to both the U.S. Census Bureau's data and Statistics Canada's data (25 years of age and older) was used.

Figure 31. Educational profile of the sample population from the United States, compared to the general population aged 25 years and more (U.S. Census Bureau, 2010).



In short, the sample population for the on-line questionnaire was more educated than the general population, as the participants exceeded the education levels of the general populations of their countries when compared to the same age groups. These results were not surprising, since any astronomy-related leisure is considered to be rather knowledge-intensive.

6.2.2 Results of the Serious Leisure Inventory and Measure Instrument

The 18 factors that were tested in the Serious Leisure Inventory and Measure were measured via a 9-item Likert scale, ranging from 1 for "Completely Disagree" to 9 for "Completely Agree". For the analysis of the results, these values were brought down to a scale of 0 to 8 for convenience as the survey was programmed that way.

As mentioned in the Methodology section on page 79, two conditions had to be met to ensure the validity of the results:

1. That the population sample is randomly selected from the studied population.
   While the sample population was one of convenience rather than selected randomly, this condition is deemed to have been met. While a survey of all astrocasters would have represented the ideal situation, the size of the sample compared to the population is nonetheless significant (20 out of 92, or 21.7%), and certainly pertinent, which leads to the reasonable assumption that the sample is representative of the whole.

2. That the observations be independent of one another.
   Again, as the sample population is one of convenience, true independence between each participant's responses could not be verified. However, as each participant answered the questionnaire from separate computers (each responded from different IP addresses using individualized links to the survey), this condition is believed to have been met.

The results of the chi-squared goodness-of-fit test [9] for the SLIM are given in Table 1 below.

[9] The chi-squared (X^2) goodness-of-fit test is used to compare the results obtained to the expected values (those obtained when the SLIM instrument was created).

Table 1: Chi-Squared Goodness-of-Fit Test results for the SLIM (See Appendix I for detailed responses)

Measured Factor	Factor Response Mean ± σ	Values from Gould (2005) & (2010)	X^2_{17}
Perseverance (PS)	7.017 ± 1.097	6.002	
Effort (EF)	6.967 ± 1.178	6.074	
Career progress (CP)	6.950 ± 1.556	6.456	
Career contingencies (CC)	6.233 ± 1.701	5.513	
Personal enrichment (PE)	6.833 ± 1.044	6.430	
Self-actualization (SA)	5.417 ± 2.085	5.413	
Self-expression of abilities (SEA)	5.967 ± 1.518	5.564	
Self-expression as an individual (SEI)	5.000 ± 1.940	5.470	
Self-image (SI)	4.017 ± 2.228	5.642	**2.932**
Self-gratification by satisfaction (SGS)	6.850 ± 1.005	6.375	**(P < 0.0001)**
Self-gratification by enjoyment (SGE)	7.850 ± 0.360	6.777	
Re-creation (RC)	6.317 ± 1.864	6.476	
Financial return (FR)	0.950 ± 2.012	0.824	
Group attraction (GAT)	6.650 ± 1.764	5.535	
Group accomplishments (GAC)	6.067 ± 1.376	4.893	
Group maintenance (GMA)	6.550 ± 1.501	4.704	
Unique ethos (UE)	6.733 ± 1.494	5.171	
Identity (IDE)	5.533 ± 1.467	5.653	

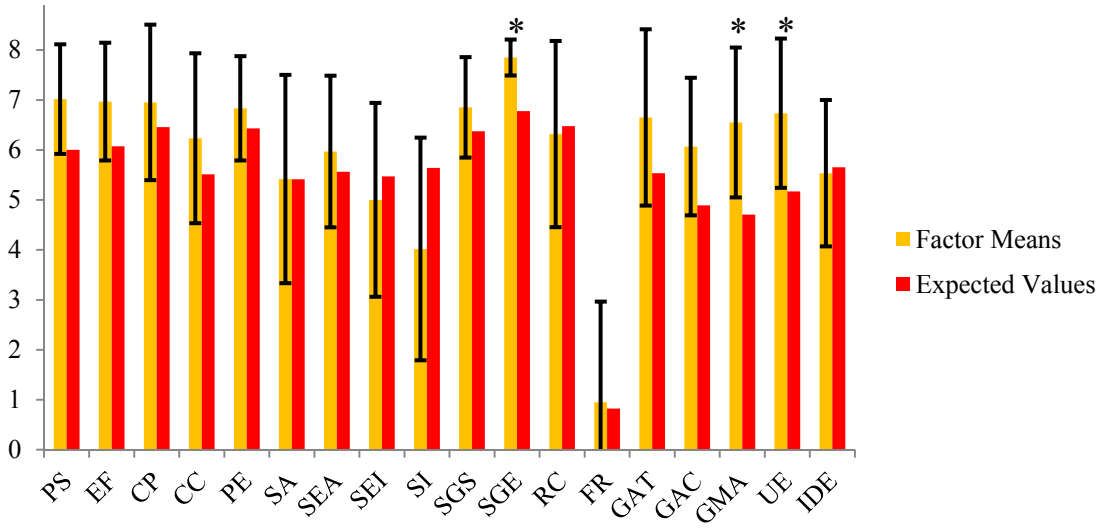
The representative value calculated from the goodness-of-fit test when the obtained results from the 18 factors were compared to those by Gould is $X^2_{17} = 2.982$.[10] When this number is checked against the critical values in reference tables available in statistics manuals (such as those from Norman & Streiner (2008, p. 364) and Rumsey (2009, p. 374)) the

[10] X^2_{17} simply means chi-squared (X^2) obtained from 17 dimensions (n-1, 18 factors measured minus 1) tested with the SLIM.

interpretation obtained is that the probability that Hypothesis H_1 is proven false is less than 0.01% ($P<0.0001$). Put simply, the pattern displayed by the values obtained for the 18 factors measured have a better than 99.99% chance of being the same as that from the values given as a reference when the SLIM instrument was built. Therefore, Hypothesis H_1, that the population studied considers astrocasting as a serious leisure activity, is accepted as true.

Despite the level of certainty displayed by the goodness-of-fit test, there are minor but statistically significant differences between the values measured for 3 of the 18 factors measured, as displayed in Figure 32.

Figure 32. Measured Factor Means and Expected Values (Gould J. , Personal commumication, 2010). The factors that deviated substantially from the expected values are marked with an asterisk.



Each measured factor had an uncertainty value associated with it that is inherent from measuring 20 responses from the sample population (i.e. they didn't all give exactly the

same answer for each question). For example, for the factor Perseverance (PS), the obtained value of 7.017 is the best estimate from the sample population; the uncertainty associated with this factor is 1.097. In other words, for PS, the true value for the sample population is situated in an interval (represented by the black bars in Figure 5) from 5.920 (7.017 minus 1.097) to 8.114 (7.017 plus 1.097). Since the value obtained by Gould when the instrument was built is 6.002 for Perseverance, the value measured from the administration of the SLIM is said to be within range, and therefore did not vary significantly from the expected value. The same can be said for 14 other factors.

However, for 3 measured factors, (Self-Gratification by Enjoyment (SGE), Group Maintenance (GMA), and Unique Ethos (UE)), the values obtained varied significantly from those obtained when the SLIM instrument was built. For example, for Group Maintenance (GMA), the measured value was 6.550, plus or minus 1.501, and the value from Gould is 4.704; this indicates that there is a statistically significant difference between the measured value for Group Maintenance and the value that was expected from Gould. In other words, for the three measured factors where this occurred, the expected values were outside the error bars associated with the measured values in Figure 5 (those marked with an asterisk).

Differences such as these were expected, as the SLIM instrument was built using a convenience sample from which the participants self-nominated three activities that they considered serious leisure activities, none of which was related to astronomy, or to any cerebral leisure activity for that matter (Gould J. M., 2005, p. 108). Nevertheless, the facts that 1) the observed pattern of values matches without ambiguity that from the values obtained by

Gould, and 2) that 15 out of 18 measured factors were within range of these expected values, demonstrate that the theoretical framework upon which the SLIM was founded upon is valid, and shows robustness when used across different serious leisure activities.

6.2.3 Results of the Leisure Motivation Scale (LMS)

The type of motivation that drives the sample population to do astrocasting as a leisure activity was tested in the second part of the on-line questionnaire using the LMS, the Leisure Motivation Scale (Pelletier L. G., Vallerand, Brière, & Blais, 1989), described earlier in the Methodology section on page 80. A 7-item Likert Scale (from 1 for "Does not correspond at all" to 7 for "Corresponds exactly") was used. Once again, these values were brought down to a scale of 0 to 6 for analysis as the survey was programmed that way.

6.2.3.1 Preliminary Analysis

To ensure that the results are valid, a preliminary analysis of the results was done to verify that the responses to each type of motivation are independent of each other. As the instrument contains 28 questions, with 4 questions per category (or type of motivation), two analyses were required. The first one was done to verify that there is a lack of independence among the 28 questions; this was naturally expected here because of the plurality of questions that measure the responses to the same type of motivation. The second analysis was done to verify that the responses to each category were independent of each other, to confirm that there are no mixed signals between them.

These two data explorations were done using a statistical tool called "Analysis of Variance", or ANOVA. This analytical method looks for relationships in data when each

data point is a mean of all the responses to a question, as is the case in this study since each question has been answered by the 20 participants. For the purposes of this study, two ANOVAs were done with the results obtained: the first one (regular ANOVA) looked at the possibility that there are relationships between each individual question, and the second one (called "Nested ANOVA" because it compares groups of questions) at the possibility that there are relationships between each category of questions (one category per motivation type). The detailed responses to all of the questions of the LMS are detailed in Appendix J.

As mentioned in the Methodology section on page 80, four conditions had to be met in order to conduct the ANOVAs. As the first two were the same than for the SLIM, only those related to the ANOVAs are dealt with here:

1. That the sample comes from a population with a normal distribution. This condition is rarely tested formally, because "…unless there is reason to suspect a fairly extreme departure from normality, it is probable that the conclusions drawn from the data … will not be seriously affected" (Ferguson & Takane, 1989). Furthermore, "There's another good reason not to worry about it… From the Central Limit Theorem,[11] the means will be normally distributed, regardless of the original distribution, especially when there are at least 30 or so observations per group" (Norman & Streiner, 2008, p. 80). As there are 560 observations done in the LMS (20 participants times 28 questions), this condition is considered to have been met.

[11] "The Central Limit Theorem states if we draw equally sized samples from a non-normal distribution, the distribution of the means of these samples will still be normal, as long as the samples are large enough" (Norman & Streiner, 2008, p. 32).

2. That the residuals are homoscedastic, i.e. "that the standard deviations stay the same across (all categories)" (Rumsey, 2009, p. 73).

   Here, guidance from Norman and Streiner is of significant help, as they mention that ANOVAs are "fairly robust to deviations from homoscedasticity (…) especially if the groups have equal sample sizes, and the populations (not the samples) are normally distributed" (2008, p. 80). Since the sample size for each category was the same (all the participants answered the 28 questions), and that the population is considered normally distributed (see point 1 above), this condition is considered met.

The results of the first ANOVA showed that there were indeed correlations between individual questions (See Appendix J for detailed results). This was determined by calculating the probability that there was independence between the question means. As the probability obtained is 88%, and that the generally-accepted rule is that this must be 95% or above, the conclusion was that there was indeed a lack of independence between the questions, as was expected since there were 4 questions per type of motivation.

For the nested ANOVA, the same 95% threshold applies between the responses to each category; the result obtained is better than 99.9%. Therefore, the responses to each type of motivation are deemed independent of each other, and can therefore be used with confidence.

6.2.3.2 Results of the LMS and Discussion

Table 2 below shows the results of the responses to the seven types of motivation measured by the LMS.

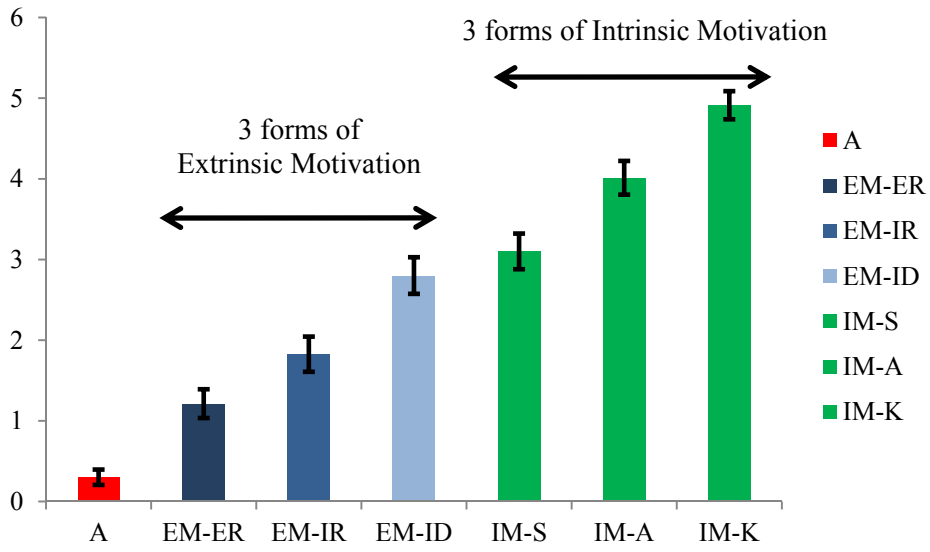
Table 2 : Results of the LMS. The means for each type of motivation (and their standard error) are shown in the second column.

Type of Motivation	Factor response (Mean ± Standard Error)
Amotivation (A)	0.300 ± 0.095
Extrinsic Motivation by External Regulation (EM-ER)	1.212 ± 0.179
Extrinsic Motivation by Introjection Regulation (EM-IR)	1.825 ± 0.218
Extrinsic Motivation by Regulation through Identi-fication (EM-ID)	2.800 ± 0.228
Intrinsic Motivation to Experience Stimulation (IM-S)	3.100 ± 0.221
Intrinsic Motivation to Accomplish (IM-A)	4.013 ± 0.209
Intrinsic Motivation to Know (IM-K)	4.913 ± 0.174

As described in section 4.3.2 of the Theoretical Framework section on page 72, all three forms of Intrinsic Motivation are equivalent on the Self-Determination Continuum, i.e. they must be considered together when compared to the other forms of motivation. Therefore, in

Figure 6 below, they are all shown in the same shade of green, while Amotivation is shown in red, and the three forms of Extrinsic Motivation are shown in varying shades of blue.

Figure 33. Means and standard errors for each type of motivation from the sample population (data from Table 2).

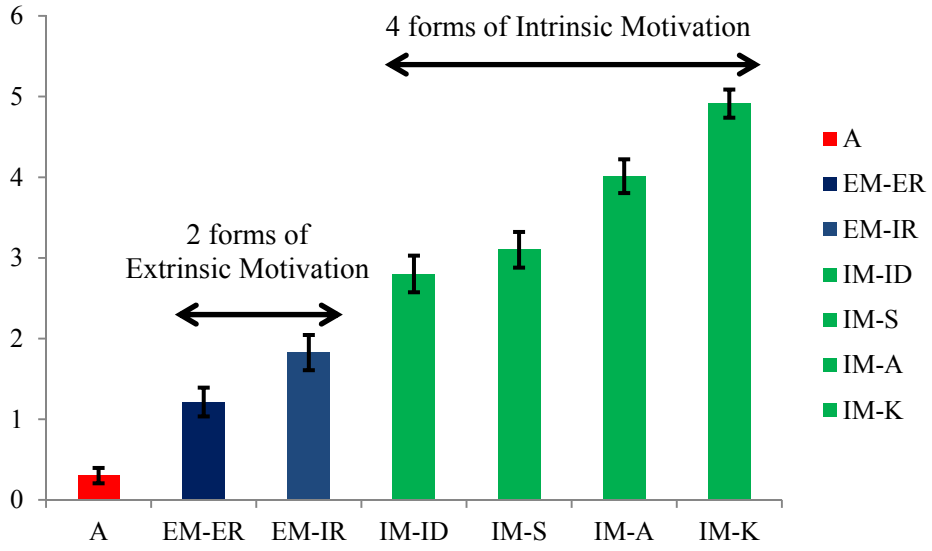


The results show that the lowest form of motivation obtained is Amotivation (A), and the highest is Intrinsic Motivation (to Experience Stimulation (IM-S), to Accomplish (IM-A), and to Know (IM-K)), with all three forms of Extrinsic Motivation shown in between (by External Regulation (EM-ER), by Introjection Regulation (EM-IR), and by Regulation through Identification (EM-ID)). However, a closer examination of the results shows that the results for Extrinsic Motivation by Regulation through Identification (EM-ID) and the Intrinsic Motivation to Experience Stimulation (IM-S) are statistically similar, i.e. their error bars overlap on Figure 6. As these results have been confirmed as independent by the nested

ANOVA analysis on page 110, this comes as a surprise, as one would have expected them to be further apart as they are two different forms of motivation.

There are two possibilities that may explain this overlapping. The first one is that the Motivation by Regulation through Identification is intrinsic to the sample population; that is, the behaviour that results from this type of motivation comes entirely from the person, without outside prompting. This would imply that it should also be considered with the three other forms of Intrinsic Motivation, as shown in Figure 34.

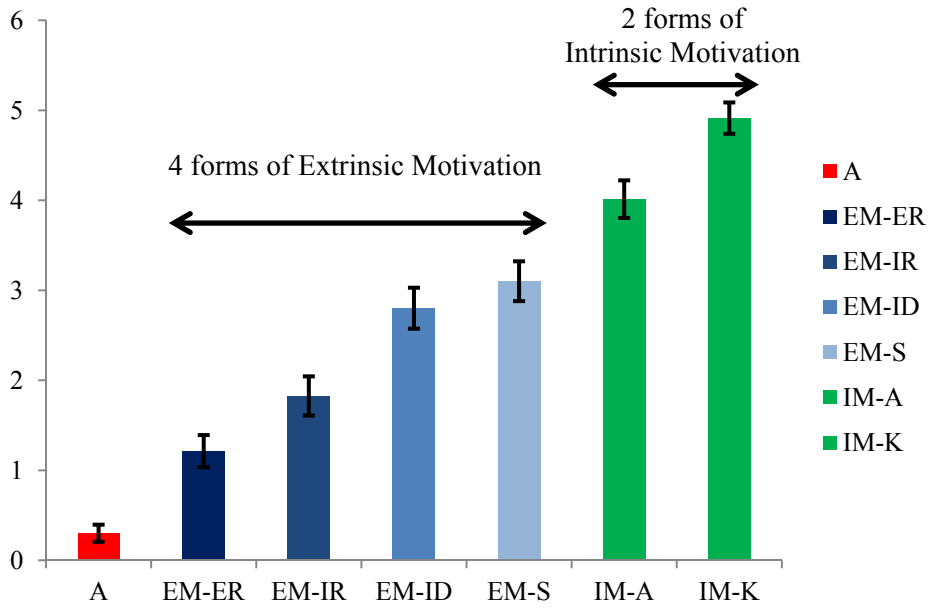
Figure 34. Means and standard errors for each type of motivation, with the Motivation by Regulation through Identification considered to be Intrinsic (IM-ID) for the sample population (green bars).



The second possibility is that the Motivation to Experience Stimulation is extrinsic for the sample population; that is, that the resulting behaviour is initiated by outside stimuli. This would imply that it ought to be considered separately from the other two forms of In-

trinsic Motivation, as shown in Figure 8.

Figure 35. Means and standard errors for each type of motivation, with the Motivation to Experience Stimulation considered to be Extrinsic (IM-ID) for the sample population (4 bars of different shades of blue).



Startlingly, these two possibilities quantitatively demonstrate an issue described in the focus group discussions in section 6.1.3 on page 95; that of whether the will to target the same objects that were seen on previous astrocasts is intrinsic or extrinsic to the participants. This further validates the LMS when it comes to measuring each type of motivation, while at the same time indicating that the Self-Determination Continuum for the types of motivation may not be as fixed in stone as the theory suggests. This reaffirms the view expressed by Deci & Ryan, mentioned on page 70, that the definitions of the various forms of motivation may vary depending on whether it is external or internal for a given individual, as it is based on his or her individual "... capacity to choose and to have those choices, rather than rein-

forcement contingencies, drives, or any other forces or pressure, be the determinants of one's actions." (Deci & Ryan, 1985, p. 38). Further research combining both the LMS and focus groups on a given leisure activity is necessary to further explore this question.

Nevertheless, even when considering these two possibilities (grouping IM-S with the other three types of extrinsic motivation, or grouping EM-ID with the other three types of intrinsic motivation), the results remain the same: the highest form of motivation shown by the participants is Intrinsic Motivation. Ergo, since Hypothesis H_2 postulated that those who partake in astrocasting are intrinsically motivated to do so, we can conclude that H_2 is validated.

Furthermore, the separate levels of intrinsic motivation obtained through the LMS can also indicate their relative importance. The results show that, for the participants, they are, in decreasing order: 1) Intrinsic Motivation to Know, 2) Intrinsic Motivation to Accomplish, and 3) Intrinsic Motivation to Experience Stimulation. This result assumes, of course, that the Motivation to Accomplish is intrinsic, and the Motivation by Regulation through Identification is extrinsic, as suggested by the Self-Determination Continuum in the Theoretical Framework on page 72.

6.2.4 Discussion

The large proportion of the sample population relative to the population studied renders reasonable the assumption that the sample of convenience in this study behaved as well as if the sample population of astrocasters had been obtained randomly. Furthermore, the prerequisite that the observations were independent of one another was satisfied by the fact that

each participant received a personalized link to the on-line survey and answered them from separate IP addresses. Ergo, the requirements for both the Serious Leisure Inventory and Measure and the Leisure Motivation Scale questionnaires that the sample population be randomly selected, and that the observations be independent of one another, have been achieved. As for the extra two conditions necessary to perform the ANOVA analyses for the LMS (that the sample comes from a population with a normal distribution, and that the residuals are homoscedastic) they were also considered met when the large number of observations (580 in total) and the equal number of responses to each question were considered.

One question has dogged the study of motivation when it comes to leisure activities: did the participants view the activity that they were partaking in as a leisure activity, and if so, what type? This research project has eliminated that variable quantitatively by using the Serious Leisure Inventory and Measure to determine if the activity under study was viewed as a leisure activity by its participants, and if they viewed it as the same type of leisure activity (serious, project-based, or casual). Indeed, the combination of the SLIM with the Leisure Motivation Scale dealt effectively with the main complaint enunciated by Pelletier *et al.* in their paper validating the LMS: "…Leisure is an abstraction that seeks to integrate a large variety of heterogeneous activities under a common conceptual definition. This variety is often a source of ambiguity" (Pelletier L. , Vallerand, Green-Demers, Blais, & Brière, 1996, p. 577).

The analysis of the data from the on-line survey revealed that the results from the three sections (socio-demographic, SLIM, and LMS) were consistent with each other. The socio-

demographic section showed that the education level of astrocasters is higher than the general population, that they considered astrocasting as a serious leisure activity, and that they were intrinsically motivated to do. Furthermore, the LMS also showed the relative importance of the types of intrinsic motivation for astrocasters: the Intrinsic Motivation to Know was the strongest, followed by the Intrinsic Motivation to Accomplish and the Intrinsic Motivation to experience stimulation. However, the statistically similar results of the Intrinsic Motivation to Experience Stimulation and the Extrinsic Motivation by Regulation through Identification may indicate that these forms of motivation might be experienced differently by the astrocasters than the theoretical framework suggests. This confirms a finding from the focus group sessions that these two forms of motivation might be experienced differently among the participants. Despite this, the results are unchanged; the main form of motivation experienced by the sample population towards astrocasting was intrinsic.

These results lead to a question: is the relative importance of each type of intrinsic motivation constant across all partakers of serious leisure activities? While one may want to look at the results of past applications of the LMS, their comparison would be conceptually weak if a common instrument, such as the SLIM, were not applied concurrently to determine if the activities were indeed viewed as a leisure activity, and if they were viewed as a common type (serious, project-based, or casual). Although it may be possible to review the results of the past studies where the LMS was used by looking at the relationships of the factors used in both the SLIM and the LMS that could be derived from this study, further research in this direction could answer this question more conclusively, as this was not the purpose of this project, especially when considering that this is believed to be the first concurrent applica-

tion of both the SLIM and LMS in the study of a leisure activity. And finally, to further confirm the robustness of the SLIM towards a wide variety of serious leisure activities (encompassing both the physical and cerebral types), more studies involving the application of the SLIM are needed.

7. Conclusion

This research looked at the emerging phenomenon that is astrocasting, i.e. the sharing on a dedicated Social Media Web site of live astronomical observing sessions using the video feed produced by a Mallincam attached to a telescope. This was looked at using a three-pronged approach: 1) by determining if the web site is truly a Social Media one, 2) by testing a sample of the astrocasting community to find if those who partake in astrocasting consider it as a serious leisure activity under the Serious Leisure Perspective, and 3) by typifying the motivation type of astrocasters using the Self-Determination Theory of Motivation.

The site in question was Night Skies Network (http://www.nightskiesnetwork.com). In the Theoretical Framework section dealing with this Social Media site, it was demonstrated that it met all the requirements in order to be considered a Social Media site as defined by boyd and Ellison (boyd [*sic*] & Ellison, 2008, p. 211). Furthermore, astrocasting in general has been found to remove two forms of tyranny of locality; the first related to having to stand at the eyepiece of a telescope to observe its target, and the second related to standing next to the monitor displaying the live images from the video camera attached to the telescope. In other words, everyone connected to the Internet could participate in these astrocasting sessions, either as a broadcaster or as a viewer, with both being able to provide content during these sessions. Finally, the economic model for this Social Media site was found to be of the Freemium type, according to the classification system described by Anderson (Anderson, 2009, p. 26).

A focus group was conducted in two 90-minute sessions in January 2010 among a small group of astrocasters from the Ottawa, Ontario region. The findings revealed that the participants were passionate about astrocasting, which enabled them to surmount the various technical obstacles inherent to this leisure activity. Also, they displayed a high level of collegiality amongst themselves, which helped speed up the learning process for all, and broaden the outreach possibilities.

A second sample from the astrocasting population was recruited for an on-line questionnaire composed of the Serious Leisure Inventory and Measure (SLIM) instrument and the Leisure Motivation Scale (LMS) in order to determine 1) if the population studied considered astrocasting as a Serious Leisure activity, and 2) if those who partook in astrocasting were intrinsically motivated to do so. One of the strengths of the combination of these two questionnaires was that it dealt effectively with the main weakness inherent with the LMS alone by ensuring that the participants consider the studied leisure activity the same way (i.e. as a casual, project-based, or serious leisure activity). The participants filled the on-line questionnaire over a period of six weeks in January and February 2010. The socio-demographic data from the sample population revealed that it was generally more educated than the general population.

The results of the short-form of the SLIM (54 questions versus 72 for the long-form) revealed that the sample population of astrocasters did indeed consider astrocasting as a serious leisure activity. The pattern of the results of the 18 factors that were measured had a better than 99.99% chance of being the same as the one established when the instrument was

constructed (Gould J. M., 2005), despite the fact that 1) the serious leisure activities used during its elaboration were all physical activities, and in no way related to a cerebral activity, and 2) 3 of the 18 measured factors showed a significant difference from the published values. This demonstrated the robustness of the Serious Leisure Perspective, but further research is needed to confirm this over a wide range of serious leisure activities.

As for the 28-question LMS, preliminary analyses of variances (ANOVAs) endorsed its validity by showing that there was some correlation between the questions (which was normal as there were 4 questions measuring each type of motivation), and no correlation between the categories of questions (99.9% chance of them being independent). Later, it was determined that the sample population of astrocasters was intrinsically motivated towards its leisure activity, with the Intrinsic Motivation to Know coming out the strongest, followed by the Intrinsic Motivation to Accomplish and the Intrinsic Motivation to Experience Stimulation.

An interesting result came out from the LMS, where the result for the Extrinsic Motivation through Regulation by Identification was statistically the same as that for the Intrinsic Motivation to Experience Stimulation. While this further validated the construct of the LMS when it came to measuring each type of motivation on the Self-Determination Continuum, the location of each type of motivation within this framework may not be fixed. Further research combining both the LMS and focus groups on other leisure activities would be necessary to further explore this question.

As for the applicability of the results of the on-line questionnaire, while the results obtained are representative of the sample only, the large proportion of the sample when compared to the whole population (20 out of 92, or 21.7%) makes the conclusions reached above reasonably applicable to the whole population as well.

And finally, as this phenomenon emerged relatively recently on the Internet, a longitudinal study of astrocasting (and Night Skies Network in particular) would be useful to describe its evolution as a specialized Social Media site, as it would provide further insight on the life cycle of other similar sites.

Bibliography

American Customer Satisfaction Index. (2010). Retrieved March 6, 2010, from Wikipedia: http://en.wikipedia.org/wiki/American_Customer_Satisfaction_Index

Amazon.com, Inc. (2010, March). *Amazon Media Room: Media Kit: Timeline and History*. Retrieved March 4, 2010, from Amazon Media Room: http://phx.corporate-ir.net/phoenix.zhtml?c=176060&p=irol-corporateTimeline

Anderson, C. (2008). *The Long Tail* (2nd ed.). New York: Hyperion.

Anderson, C. (2008). *The World in 2008 | Freeconomics.* Retrieved May 25, 2008, from The Economist: http://www.economist.com/

Anderson, C. (2009). *Free: The Future of a Radical Price* (1st ed.). Hyperion.

Appelbaum, A. (2001). The Constant Customer. *Gallup Management Journal, 1*(2), 5.

Aronson, E. (1992). The Return of the Repressed: Dissonance Theory Makes a Comeback. *Psychological Inquiry, 3*(4), 303-311.

Astrochannels. (2006). *Astrochannels - Live Video of Deep Space Objects*. Retrieved May 31, 2008, from Astrochannels: http://www.astrochannels.com/livevideo.html

Astronomical League. (2003). *Astronomical League - Astronomy Day*. Retrieved May 31, 2008, from Astronomical League: http://www.astroleague.org/al/astroday/astrowinners.html

Balkenius, C. (1995). Natural Intelligence in Artificial Creatures. 286. Sweden: Lunds Offset.

Berners-Lee, T., & Caillau, R. (1990, November 12). *WorldWideWeb: Proposal for a HyperText Project.* Retrieved March 1, 2010, from World Wide Web Consortium (W3C): http://www.w3.org/Proposal.html

boyd, d. m. [*sic*], & Ellison, N. B. (2008). Social Network Sites: Definition, History, and Scholarship. *Journal of Computer-Mediated Communication, 13*(1), pp. 210-230.

Boyle, G. (2008, April 14). *OAOG: Message: Astrocasting*. Retrieved June 1, 2008, from OAOG Yahoo! Discussion Group: http://tech.groups.yahoo.com/group/OAOG/message/40996

Cinzano, P., Falchi, F., & Elvidge, C. D. (2001). The first World Atlas of the artificial night sky brightness. *Monthly Notices of the Royal Astronomical Society, 328*, pp. 689-707.

Congress, T. L. (1991, December 9). High-Performance Computing Act of 1991, S.272. Washington, D.C.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-Determination in Human Behavior.* New York: Plenum Press.

Deci, E. M., & Ryan, R. M. (2002). An Overview of Self-Determination Theory: An Organismic-Dialectical Perspective. In E. M. Deci, & R. M. Ryan (Eds.), *Handbook of Self-Determination Research* (p. 3). Rochester, N.Y.: The University of Rochester Press.

eBay Inc. (2010). *History - eBay Inc.* Retrieved March 3, 2010, from eBay Inc.: http://www.ebayinc.com/list/milestones

Ferguson, G. A., & Takane, Y. (1989). *Statistical analysis in psychology and education* (Sixth ed.). New York: McGraw Hill.

Ferguson, M. J., Hassin, R., & Bargh, J. A. (2008). Implicit motivation: Past, Present, and Future. In J. Y. Shah, & W. L. Gardner (Eds.), *Handbook of Motivation Science* (pp. 150-166). New York: The Guilford Press.

Festinger, L. A. (1957). *A Theory of Cognitive Dissonance.* White Plains, NY: Row, Peterson and Company.

Fiske, S. T. (2008). Core Social Motivations. In J. Y. Shah, & W. L. Gardner (Eds.), *Handbook of Motivation Science* (pp. 3-22). New York, NY, USA: The Guilford Press.

Gable, S. L., & Strachman, A. (2008). Approaching Social rewards and Avoiding Social Punishments. In J. Y. Shah, & W. L. Gardner (Eds.), *Handbook of Motivation Science* (pp. 561-575). New York: The Guilford Press.

Galileo, G. (1610). *Sidereus Nuncius* (1st ed.). (T. Baglionum, Ed.) Venice.

Gerst, M. D. (1971). Symbolic Coding Processes in Observational Learning. In A. Bandura (Ed.), *Psychological Modeling: Conflicting Theories.* New York: Aldine Atherton, Inc.

Gould, J. (2010). Personal commumication.

Gould, J. M. (2005). The Development Of A Serious Leisure Inventory and Measure. 144. Clemson, SC, USA: Clemson University.

Gould, J., Moore, D., McGuire, F., & Stebbins, R. (2008). Development of the Serious Leisure Inventory and Measure. *Journal of Leisure Research, 40*(1), 47-68.

Grewal, R., Cline, T. W., & Davies, A. (2003). Early-Entrant Advantage, Word-of-Mouth Communication, Brand Similarity, and the Consumer Decision-Making Process. *Journal of Consumer Psychology, 13*(3), 187-197.

Harris Interactive Inc. (2008, December 4). *Leisure Time Plummets 20% in 2008 - Hits New Low.* Retrieved January 4, 2010, from Harris Interactive: http://www.harrisinteractive.com/vault/Harris-Interactive-Poll-Research-Time-and-Leisure-2008-12.pdf

Hartel, J. (2007). *SLP Diagram*. Retrieved February 1, 2010, from The Serious Leisure Perspective: http://www.soci.ucalgary.ca/seriousleisure/DescriptivePages/SLPDiagram.htm

Hertel, G., Niedner, S., & Herrmann, S. (2003). Motivation of software developers in Open Source projects: an Internet-based survey of contributors to the Linux kernel. *Research Policy, 32*, pp. 1159-1177.

Howe, W. (2010, March 24). *A Brief History of the Internet*. Retrieved March 25, 2010, from Walt Howe's Internet Learning Tree: http://www.walthowe.com/navnet/history.html

Hunt, C. (2002). *TCP/IP Network Administration* (3rd ed.). Sebastopol, CA: O'Reilly and Associates, Inc.

IBM Business Consulting Services. (2006). *The end of television as we know it.* Somers, New York, USA: IBM Global Services.

International Occultation Timing Association. (2007). *Chasing the Shadow: The IOTA Occultation Observer's Manual.* (R. Nugent, Ed.) Retrieved June 1, 2008, from The International Occultation Timing Association: http://www.poyntsource.com/IOTAmanual/IOTA_Observers_Manual_all_pages.pdf

International Telecommunications Union. (2008). *Internet user penetration rates worldwide and for developed and developing regions, between 1997 and 2007.* Retrieved March 5, 2010, from International Telecommunications Union: http://www.itu.int/ITU-D/ict/statistics/ict/graphs/internet.jpg

Internet Systems Consortium. (2009). *Internet host count history*. Retrieved March 1, 2010, from Internet Systems Consortium: https://www.isc.org/solutions/survey/history

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! THe challenges and opportunities of Social Media. *Business Horizons, 53*, 59-68.

Koole, S. L., & Kuhl, J. (2008). Dealing with Unwanted Feelings. In J. Y. Shah, & W. L. Gardner (Eds.), *Handbook of Motivation Science* (pp. 295-307). New York: The Guilford Press.

Le musée du Louvre. (1995). *Rapport d'activité du musée du Louvre 1995.* Paris.

Legault, D. (2002, October 17). *Mallincam: Message: New Member*. Retrieved May 31, 2008, from Mallincam Yahoo! Discussion Group: http://tech.groups.yahoo.com/group/mallincam/message/2

Legendre, R. (Ed.). (2005). Dictionnaire actuel de l'éducation, 3e édition. 1554. Montreal: Guérin, Éditeur limitée.

Lewin, K. (1936). *Principles of Topological Psychology.* (F. Heider, & G. M. Heider, Trans.) New York: McGraw-Hill Book Company, Inc.

Maehr, M. L., & Sjogren, D. D. (1971). Atkinson's Theory of Achievement Motivation: First Step Toward a Theory of Academic Motivation? *Review of Educational Research, 41*(2), 143-161.

Mallin, R. (2008, February 20). *mallincam: Message: Thank You!* Retrieved March 15, 2009, from mallincam · Astronomy Video CCD Camera discussion group on Yahoo!: http://tech.groups.yahoo.com/group/mallincam/message/5071

Mallin, R. (2009, 03 17). Personal communication.

Mallin, R. (2010, January 1). *mallincam: Message: Great News for All*. Retrieved January 3, 2010, from Mallincam Yahoo! Discussion Group: http://tech.groups.yahoo.com/group/mallincam/message/12746

Martin, P. (2003, February 08). *OAOG: Message: What a night!!!* Retrieved May 31, 2008, from OAOG Yahoo! Discussion Group: http://tech.groups.yahoo.com/group/OAOG/message/10973

Maslow, A. H. (1943). A Theory of Human Motivation. *Psychological Review, 50*, pp. 370-396.

Masters, K. (2009). *File:WIntHosts1981-2009.jpg.* Retrieved March 1, 2010, from Wikipedia: http://en.wikipedia.org/wiki/File:WIntHosts1981-2009.jpg

Microsoft Research. (2009). *WorldWide Telescope - In Depth*. Retrieved February 23, 2010, from WorldWide Telescope: http://www.worldwidetelescope.org/whatIs/WhatIsWWT.aspx?Page=InDepth

NASA. (2010, November 24). *Stripes are Back in Season on Jupiter.* Retrieved February 7, 2011, from NASA: http://www.nasa.gov/topics/solarsystem/features/jupiter20101124.html

Norman, G. R., & Streiner, D. L. (2008). *Biostatistics: The Bare Essentials* (3rd ed.). Hamilton, ON: BC Decker Inc.

OAOG. (2001, November 24). *What's this astronomy group all about?* Retrieved May 31, 2008, from Ottawa Valley Astronomy and Observers Group: http://www.oaog.ca/whats.htm

OECD. (2007). *Participative Web and User-created ContentWeb 2.0, Wikis and Social Networking.* Paris.

Pelletier, L. G., Vallerand, R. J., Brière, N. M., & Blais, M. R. (1989). Construction et validation de l'Échelle de motivation vis-à-vis les Loisirs. *Congrès annuel de la SQRP*, (p. 146). Ottawa.

Pelletier, L. G., Vallerand, R. J., Green-Demers, I., Brière, N. M., & Blais, M. R. (1995). Loisirs et santé mentale: Les relations entre la motivation pour la pratique des loisirs et le bien-être psychologique. *Revue canadienne des sciences du comportement, 27*(2), pp. 140-156.

Pelletier, L., Vallerand, R. J., Green-Demers, I., Blais, M. R., & Brière, N. M. (1996). Vers une conceptualisation motivationnelle multidimensionnelle du loisir : Construction et

validation de l'Échelle de Motivation vis-à-vis des Loisirs (EML). *Society and Leisure, 19*(2), pp. 559-585.

Plaut, V. C., & Markus, H. R. (2005). The "Inside" Story: A Cultural-Historical Analysis of Being Smart and Motivated, American Style. In A. J. Elliot, & C. S. Dweck (Eds.), *Handbook of Competence and Motivation* (pp. 457-488). New York: The Guilford Press.

Radsma, J., & Bottorff, J. L. (2009). Counteracting Ambivalence: Nurses Who Smoke and Their Health Promotion Role With Patients Who Smoke. *Research in Nursing & Health,, 32*, 443-452.

Rozell, D. J. (2009, December). Night Lights: Too Much of a Good Thing? *The New York State Conservationist, 64*(3), 22-26.

Rumsey, D. (2009). *Statistics II for Dummies.* Hoboken, NJ: Wiley Publishing, Inc.

Ryan, R. M., & Deci, E. L. (2002). An Overview of Self-Determation Theory; An Organismic-Dialectical Perspective. In E. L. Deci, & R. M. Ryan (Eds.), *Handbook of Self-Determination Research* (p. 15). Rochester, N.Y.: The University of Rochester Press.

Short, S. (2008, November 12). *mallincam: Message: Pulling the plug on Yahoo LIVE*. Retrieved January 5, 2010, from Mallincam Yahoo! Discussion Group: http://tech.groups.yahoo.com/group/mallincam/message/7430

Sidewalk Astronomers. (2004). *John Dobson - A Brief Biography*. Retrieved June 1, 2008, from Sidewalk Astronomers: http://www.sidewalkastronomers.us/id32.html

Software Tool & Die. (2006, April 27). *The World's Home Page*. Retrieved January 15, 2010, from www.theworld.com

Statistics Canada. (2011). Table 282-0004 - Labour force survey estimates (LFS), by educational attainment, sex and age group, annual (persons unless otherwise noted), CANSIM (database). Ottawa, Ontario, Canada.

Stebbins, R. A. (1997). Casual Leisure: A conceptual statement. *Leisure Studies, 16*(1), 17-25.

Stebbins, R. A. (2005). Project-based leisure: Theoretical neglect of a common use of free time. *Leisure Studies, 24*, 1-11.

Stebbins, R. A. (2007). *Serious leisure: a perspective for our time.* New Brunswick, N.J.: Transaction Publishers.

Steege, P. (2009, March 31). *The Storage Effect: All Things Storage*. Retrieved January 12, 2010, from Seagate: http://storageeffect.media.seagate.com/2009/03/storage-effect/a-brief-history-of-the-disk-drive/

Stewart, W. (2000). *NSFNET, National Science Foundation Network*. Retrieved March 1, 2010, from The Internet: http://www.livinginternet.com/i/ii_nsfnet.htm

The Nielsen Company. (2010). *Nielsen | Profile*. Retrieved March 10, 2010, from Nielsen: http://en-us.nielsen.com/main/about/Profile

The World Bank. (2010). *The World Development Indicators (WDI) 2010.* Washington, DC.

Turner, J. (2011, August 16). Personal Communication.

U.S. Census Bureau. (1993, August 27). *Selected Historical Decennial Census Population and Housing Counts.* Retrieved May 31, 2008, from U.S. Census Bureau: http://www.census.gov/population/censusdata/table-2.pdf

U.S. Census Bureau. (2010). *International Data Base Information Gateway*. Retrieved from U.S. Census Bureau: http://www.census.gov/ipc/www/idb/worldpop.php

UNESCO. (2007, November 15). Declaration of the International year of Astronomy. New York.

UNESCO and the International Astronomical Union. (2009). *Branding and Identity Guidelines | Astronomy 2009*. Retrieved March 20, 2009, from International year of Astronomy 2009: http://www.astronomy2009.org/resources/branding/

Vallerand, R. J., & Ratelle, C. F. (2002). Intrinsic and Extrinsic Motivation: A Hierarchical Model. In E. L. Deci, & R. M. Ryan (Eds.), *Handbook of Self-Determination Research* (p. 42). Rochester, N.Y.: The Unviersity of Rochester Press.

Wahba, M. A., & Bridwell, L. G. (1976). Maslow Reconsidered: A Review of Research on the Need Hierarchy Theory. *Organizational Behavior and Human Performance, 15*, pp. 212-240.

Whois.net. (2010). *Whois.net - Domain Names*. Retrieved March 2, 2010, from Whois.net - Domain-based research services: http://www.whois.net/whois/louvre.fr

Wikipedia. (2009). *File: Maslow's Hierarchy of Needs.* Retrieved January 15, 2010, from Wikipedia: http://en.wikipedia.org/wiki/File:Maslow's_Hierarchy_of_Needs.svg

Williams, T. R. (2000). Getting Organized: A History of Amateur Astronomy in the United States. 450 p. Houston, Texas: Rice University.

Appendix A. Recruitment Letter for Volunteers for the Focus Group

January 1, 2010

Subject: Volunteers needed for astrocasting research project

Dear members of the video astronomy community,

As part of my Master's Degree in Communication at the University of Ottawa, under the supervision of Professor Pierre C. Bélanger, I am conducting a research project on the astrocasting community that has formed on the Internet since February 2008.

The main purpose of this research project is to determine what motivates amateur astronomers to broadcast live on the Internet a video signal from a Mallincam that is affixed to an astronomical telescope, i.e. astrocasting.

The duration of this research project will not exceed one year starting from October 15th, 2009.

You are receiving this invitation because you have done astrocasting in the past with a Mallincam, and have posted details of such events on discussion forums such as Cloudy Nights, the Mallincam users group, the Ottawa Valley Astronomy and Observers Group, or the Videoastro discussion forum. All you will be required to do is to participate in 2 to 3 focus group not to exceed 90 minutes each at 2800 Lancaster Road, Ottawa, ON, K1B 4S4 (Tim Hortons) to explore the reasons behind your participation in the astrocasting community. These meetings will be held in January and February 2010. Details will be provided to

those who agree to participate.

As a participant, you will be part of the sample of users on which my data collection will be based; rest assured that, as per the Ethics Committee's regulations at the University of Ottawa, all data will be anonymous, and data will be aggregated to protect your identity.

If you are interested, please contact me at my e-mail address (xxxxx at xxxxx dot xxx) and I'll fill you in on the details.

Thank you very much!

Michael F. Vasseur

Candidate

Master's Degree in Communication

University of Ottawa

Pierre C. Bélanger

Professor

Department of Communication

Faculty of Arts

University of Ottawa

Appendix B. Consent Form for the Focus Group Volunteers

Consent Form – Focus Group

Title of the study: **The Mallincam in Amateur Astronomy: how a new phenomenon emerged on the Internet.**

Researcher: **Michael F. Vasseur**

Master's Degree Candidate

Department of Communication

Faculty of Arts

University of Ottawa

E-mail: xxxxx@xxxxx.xxx

Tel: (xxx) xxx-xxxx (Cell)

Supervisor: **Pierre C. Bélanger, Ph.D.**

Professor

Department of Communication

Faculty of Arts

University of Ottawa

E-mail: xxxxx@xxxxx.xxx

Tel: (xxx) xxx-xxxx ext. xxxx

Invitation to Participate: I am invited to participate in the abovementioned research study conducted by Michael F. Vasseur and his supervisor, Prof. Pierre C. Bélanger, De-

partment of Communication, Faculty of Arts, University of Ottawa.

Purpose of the Study: The purpose of the study is to gain invaluable insights in understanding the formation and composition of scientifically-inclined social groups on the Internet, more specifically the community of astrocasters, and lead to a further understanding of their behaviour.

Participation: My participation will consist essentially of participating in focus group meetings (1 to 3) not to exceed 90 minutes each at 2800 Lancaster Road, Ottawa, ON, K1B 4S4 (Tim Hortons).

Risks: My participation in this study will entail that I volunteer information about my astronomical setup and my personal interest in astrocasting. Also, since the transcripts sent via email for verification of the comments made during the focus group will be subject to the everyday risks associated with this form of communication, the file containing the transcript will be compressed and encrypted in the .ZIP format using a password that will be sent out in a separate e-mail message to minimise these risks.

Benefits: My participation in this study will help in better understanding the formation of social groups on the Internet by using it in novel ways.

Confidentiality and anonymity: I have received assurance from the researcher that the information I will share will remain strictly confidential. I understand that the contents will be used only for the purposes of this research project, and that my confidentiality will be protected by not having any identifying information shared with anyone but the researcher,

the supervisor identified above, and the other participants in the said focus group. **Anonymity** will be protected in the following manner: all identifying information will be removed from the questionnaire before the data will be processed, and any personally-identifiable data contained in the transcript of the focus group will be anonymised, however, there are limitations to the confidentiality and anonymity of the data since members of the focus group will be aware of who is participating and the information being shared.

Conservation of data: The data collected (the digital recording of the focus group and its transcript) will be kept in a secure manner in the office of Prof. Pierre C. Bélanger for a period of five years after completion of the project, after which they will be shredded and deleted permanently from the digital media upon which the focus group has been recorded.

Voluntary Participation: I am under no obligation to participate and if I choose to participate, I can withdraw from the study at any time and/or refuse to answer any questions, without suffering any negative consequences. If I choose to withdraw, all data gathered until the time of withdrawal will be removed from the data pool and destroyed so that it will never be used for any purpose.

Acceptance: I, _____*(Name of participant),* agree to participate in the above research study conducted by Michael F. Vasseur of the Department of Communication , Faculty of Arts, University of Ottawa*,* which research is under the supervision of Professor Pierre C. Bélanger.

If I have any questions about the study, I may contact the researcher or his supervisor.

If I have any questions regarding the ethical conduct of this study, I may contact the Protocol Officer for Ethics in Research, University of Ottawa, Tabaret Hall, 550 Cumberland Street, Room 159, Ottawa, ON K1N 6N5, Tel.: (613) 562-5841, e-mail: ethics@uottawa.ca

There are two copies of the consent form, one of which is mine to keep.

Participant's signature: *(Signature)* Date: *(Date)*

Witness *(needed in the case where a participant is illiterate, blind, etc.):*

(Signature) Date: *(Date)*

Researcher's signature: *(Signature)* Date: *(Date)*

Appendix C. Interview Guide Used for the Focus Group Meetings

1. What attracts you to amateur astronomy?
2. How did you first hear of astrocasting?
3. What helped you to do astrocasting?
4. What are the main difficulties that you encountered?
5. On average, how many viewers do you have on your astrocasting channel at each session?
6. What was the key element that convinced you that you could do astrocasting?
7. What could cause you to become disinterested in astrocasting?
8. Do you expect to continue astrocasting in the future? And for how long?
9. What improvements would you suggest for astrocasting?
10. Do you think that the astrocasting phenomenon will last? And for how long?

Appendix D. Recruitment Letter for Volunteers for the On-Line Questionnaire

Subject: Volunteers needed for astrocasting research project

Dear members of the video astronomy community,

As part of my Master's Degree in Communication at the University of Ottawa, under the supervision of Professor Pierre C. Bélanger, I am conducting a research project on the astrocasting community that has formed on the Internet since February 2008.

The main purpose of this research project is to determine what motivates amateur astronomers to broadcast live on the Internet a video signal from a Mallincam that is affixed to an astronomical telescope, i.e. astrocasting.

The duration of this research project will not exceed one year starting from October 15th, 2009.

You are receiving this invitation because you have done astrocasting in the past with a Mallincam, and have posted details of such events on discussion forums such as Cloudy Nights, the Mallincam users group, the Ottawa Valley Astronomy and Observers Group, or the Videoastro discussion forum. All you will be required to do is fill in two short questionnaires on-line, between January 15 and February 28, 2010, detailing what equipment you have used, and the reasons behind your participation in the astrocasting community. The questionnaires will take approximately 60 minutes to answer. Details will be provided to those who agree to participate.

As a participant, you will be part of the sample of users on which my data collection will be based; rest assured that, as per the Ethics Committee's regulations at the University of Ottawa, all data will be anonymous, and data will be aggregated to protect your identity.

If you are interested, please contact me at my e-mail address (xxxxx at xxxxx dot xxx) and I'll fill you in on the details.

Thank you very much!

Michael F. Vasseur

Candidate

Master's Degree in Communication

University of Ottawa

Pierre C. Bélanger

Professor

Department of Communication

Faculty of Arts

University of Ottawa

Appendix E. Consent Form for the On-Line Questionnaire Volunteers

Consent Form – Web Questionnaire

Title of the study: **The Mallincam in Amateur Astronomy: how a new phenomenon emerged on the Internet.**

Researcher: **Michael F. Vasseur**

Master's Degree Candidate

Department of Communication

Faculty of Arts

University of Ottawa

E-mail: xxxxx@xxxxx.xxx

Tel: (xxx) xxx-xxxx (Cell)

Supervisor: **Pierre C. Bélanger, Ph.D.**

Professor

Department of Communication

Faculty of Arts

University of Ottawa

E-mail: xxxxx@xxxxx.xxx

Tel: (xxx) xxx-xxxx ext. xxxx

Invitation to Participate: I am invited to participate in the abovementioned research study conducted by Michael F. Vasseur and his supervisor, Prof. Pierre C. Bélanger, Department of Communication, Faculty of Arts, University of Ottawa.

Purpose of the Study: The purpose of the study is to gain invaluable insights in understanding the formation and composition of scientifically-inclined social groups on the Internet, more specifically the community of astrocasters, and lead to a further understanding of their behaviour.

Participation: My participation will consist essentially of going on-line to an assigned page on the domain http://www.surveymonkey.com on the Internet for 60 minutes, during which I will fill two questionnaires. These sessions have been scheduled for February 2010 at a time and place of my convenience that has access to the Internet.

Risks: My participation in this study will entail that I volunteer information about my astronomical setup and my personal interest in astrocasting.

Benefits: My participation in this study will help in better understanding the formation of social groups on the Internet by using it in novel ways.

Confidentiality and anonymity: I have received assurance from the researcher that the information I will share will remain strictly confidential. I understand that the contents will be used only for the purposes of this research project, and that my confidentiality will be protected by not having any identifying information shared with anyone but the researcher and the supervisor identified above.

Conservation of data: The data collected (printouts of the answers to the questionnaires) will be kept in a secure manner in the office of Prof. Pierre C. Bélanger for a period of five years after completion of the project, after which they will be shredded and deleted

permanently from the digital media upon which the focus group has been recorded.

Voluntary Participation: I am under no obligation to participate and if I choose to participate, I can withdraw from the study at any time and/or refuse to answer any questions, without suffering any negative consequences. If I choose to withdraw, all data gathered until the time of withdrawal will be removed from the data pool and destroyed so that it will never be used for any purpose.

Acceptance: I, _____*(Name of participant),* agree to participate in the above research study conducted by Michael F. Vasseur of the Department of Communication , Faculty of Arts, University of Ottawa*,* which research is under the supervision of Professor Pierre C. Bélanger.

If I have any questions about the study, I may contact the researcher or his supervisor.

If I have any questions regarding the ethical conduct of this study, I may contact the Protocol Officer for Ethics in Research, University of Ottawa, Tabaret Hall, 550 Cumberland Street, Room 159, Ottawa, ON K1N 6N5, Tel.: (613) 562-5841, E-mail: ethics@uottawa.ca

Appendix F. Socio-Demographic Questions for the On-Line Questionnaire.

1. What is your age? (Less than 16), (16-25), (26-35), (36-45), (46-55), (56-65), (Above 65)
2. What is your gender? (Male), (Female)
3. From what country do you normally astrocast?
4. What is the highest level of education you have attained (non-completed, completed or ongoing): (High School), (College), (Undergraduate leading to a Bachelor's Degree), (Graduate, above a Bachelor's Degree), (Other, please specify)
5. Do you own a Mallincam? (Yes), (No)
6. Do you own the astronomical equipment used for Astrocasting? (Yes), (No)

Appendix G. Serious Leisure Inventory and Measure (SLIM) questionnaire

Short-Form

Gould, J., DeWayne, M., McGuire, F. & Stebbins, R. (2008). Development of the Serious Leisure Inventory and Measure. *Journal of Leisure Research,* 40 (1), pp.47-68.

Using the scale below, indicate to what extent each of the following items presently corresponds to one of the reasons for which you practice this leisure.

Completely disagree	Mostly disagree	Moderately disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Moderately agree	Mostly agree	Completely agree
1	2	3	4	5	6	7	8	9

WHY DO YOU GENERALLY DO YOUR LEISURE ACTIVITIES?

---

1. If I encounter obstacles in astrocasting, I persist until I overcome them.
2. By persevering, I have overcome adversity in astrocasting.
3. I overcome difficulties in astrocasting by being persistent.
4. I try hard to become more competent in astrocasting.
5. I practice to improve my skills in astrocasting.
6. I am willing to exert considerable effort to be more proficient at astrocasting.
7. I have improved at astrocasting since I began participating.
8. Since I began astrocasting, I have improved.
9. I feel that I have made progress in astrocasting.

10. For me, there are certain astrocasting-related events that have influenced my astrocasting involvement.
11. There are defining moments within astrocasting that have significantly shaped my involvement in it.
12. There have been certain high or low points for me in astrocasting that have defined how involved I am in astrocasting.
13. I have been enriched by astrocasting.
14. Astrocasting has added richness to my life.
15. My astrocasting experiences have added richness to my life.
16. I make full use of my talent when astrocasting.
17. I reach my potential in astrocasting.
18. Astrocasting has enabled me to realize my potentials.
19. Astrocasting is a way to display my skills and abilities.
20. I demonstrate my skills and abilities when astrocasting.
21. My knowledge of astrocasting is evident when participating.
22. Astrocasting for me is an expression of myself.
23. My individuality is expressed in astrocasting.
24. Astrocasting allows me to express who I am.
25. My image of self has improved since I began astrocasting.
26. Astrocasting has enhanced my self-image.
27. Astrocasting has improved how I think about myself.
28. Astrocasting provides me with a profound sense of satisfaction.

29. My astrocasting experiences are deeply gratifying.

30. Astrocasting is intensely gratifying to me.

31. Astrocasting is enjoyable to me.

32. Astrocasting is fun to me.

33. I enjoy astrocasting.

34. I feel renewed after astrocasting time.

35. I feel revitalized after astrocasting time.

36. Astrocasting is invigorating for me.

37. Financially, I have benefitted from my astrocasting involvement.

38. I have received financial payment as a result of my astrocasting.

39. I have received monetary compensation for my astrocasting expertise.

40. I enjoy interacting with other astrocasting enthusiasts.

41. I value interacting with others that are devoted to astrocasting.

42. I prefer associating with others that are devoted to astrocasting.

43. A sense of group accomplishment is important to me in astrocasting.

44. Having helped my astrocasting group accomplish something makes me feel important.

45. I feel important when I am part of my astrocasting group's accomplishments.

46. The development of my astrocasting group is important to me.

47. I contribute to the unification of my astrocasting group.

48. It is important that I perform duties which unify my astrocasting group.

49. I share many of the sentiments of my fellow astrocasters.

50. Other astrocasting enthusiasts and I share the same ideals.

51. I share many of my astrocasting group's ideals.

52. Others that know me understand that astrocasting is part of who I am.

53. I am often recognized as one devoted to astrocasting.

54. Others recognize that I identify with astrocasting.

Appendix H. Leisure Motivation Scale (LMS)

Luc G. Pelletier, Robert J. Vallerand, Marc R. Blais & Nathalie M. Brière, 1991

ATTITUDE IN LEISURE

Using the scale below, indicate to what extent each of the following items presently corresponds to one of the reasons for which you practice astrocasting.

Does not correspond at all	Corresponds a little	Corresponds moderately	Corresponds a lot	Corresponds exactly
1	2 3	4	5 6	7

WHY DO YOU GENERALLY DO YOUR LEISURE ACTIVITIES?

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1. To avoid doing other tasks.
2. Because I experience a lot of pleasure and satisfaction in learning new things.
3. Because in my opinion, it is a good way to develop social, physical or intellectual abilities that will be useful to me later.
4. For the pleasure I feel in living exciting experiences.
5. I can't come to see why I do leisure activities, and frankly I don't really care.
6. For the satisfaction I feel when I try to overcome interesting challenges.
7. Because it is very important for me to fill my free time.
8. Because I don't like to appear as someone who does nothing.

9. For the pleasure of knowing more about subjects that appeal me.
10. Because it's one of the ways that I have chosen to make improvements on a personal level.
11. For the sense of freedom that I experience while doing the activity.
12. I don't really know; I don't think that leisure activities suit me.
13. For the pleasure I feel when I outdo myself in interesting activities.
14. Because in life you absolutely need leisure activities to be happy.
15. Because sometimes it allows me to be appreciated by others.
16. Because it allows me to deepen my understanding of subjects that interest me.
17. Because it's the way I've chosen to acquire abilities in other areas that are important to me.
18. Because my leisure activities give me a real "high".
19. I don't really know; I have the impression that there isn't any activity that I could do very well.
20. For the pleasure of surpassing myself while doing activities that are challenging for me.
21. Because I absolutely must feel busy.
22. To show others that I am a dynamic person.
23. Because it allows me to explore many interesting domains.
24. Because doing leisure activities is one of the ways that allows me to develop other aspects of myself.
25. For the simple of pleasure of feeling deeply relaxed.

26. Honestly, I don't know; I have the impression that I'm wasting my time when I do leisure activities.

27. For the satisfaction I get while trying to master complex activities.

28. Because I absolutely must have my leisure time to be in a good mood.

KEY FOR LMS

# 2, 9, 16, 23	Intrinsic motivation - to know
# 6, 13, 20, 27	Intrinsic motivation - to accomplish
# 4, 11, 18, 25	Intrinsic motivation - to experience stimulation
# 3, 10, 17, 24	Extrinsic motivation - identified
# 7, 14, 21, 28	Extrinsic motivation - introjected
# 1, 8, 15, 22,	Extrinsic motivation - external regulation
# 5, 12, 19, 26	Amotivation

Appendix I. Responses to the SLIM Questionnaire and Preliminary Analysis

Table 3: Table of responses and means for SLIM

Question # and Factor		Number of responses per Likert scale element									Question means	Factor Response Mean ± σ	Expected values[12]
		0	1	2	3	4	5	6	7	8			
1	PS	0	0	0	0	0	0	5	3	12	7.35	7.017 ± 1.097	6.002
2		0	0	0	0	1	1	4	7	7	6.9		
3		0	0	0	0	2	1	2	9	6	6.8		
4	EF	0	0	0	0	1	2	3	7	7	6.85	6.967 ± 1.178	6.074
5		0	0	0	0	3	1	1	5	10	6.9		
6		0	0	0	0	0	1	2	10	7	7.15		
7	CP	0	0	0	0	2	0	2	4	12	7.2	6.950 ± 1.556	6.456
8		1	0	0	0	1	2	2	3	11	6.75		
9		0	0	0	0	2	1	2	7	8	6.9		
10	CC	0	0	1	0	3	3	2	6	5	6.15	6.233 ± 1.701	5.513
11		0	0	0	0	1	1	5	9	4	6.7		
12		1	0	1	0	3	1	4	6	4	5.85		
13	PE	0	0	0	0	0	2	5	8	5	6.8	6.833 ± 1.044	6.430
14		0	0	0	0	0	0	2	7	11	7.45		
15		0	0	0	0	0	7	4	6	3	6.25		
16	SA	0	0	0	1	2	1	4	8	4	6.4	5.417 ± 2.085	5.413
17		2	1	1	1	3	3	5	2	2	4.65		
18		0	0	0	0	2	1	2	9	6	6.8		
19	SEA	0	0	0	0	5	4	2	5	4	5.95	5.967 ± 1.518	5.564
20		0	0	1	1	2	2	7	3	4	5.9		
21		0	0	0	1	1	6	3	6	3	6.05		
22	SEI	2	1	0	0	4	3	5	3	2	4.95	5.000 ± 1.940	5.470
23		0	1	1	1	4	2	6	4	1	5.2		
24		0	2	0	0	5	6	4	3	0	4.85		
25	SI	3	1	0	0	9	4	2	1	0	3.8	4.017 ± 2.228	5.642
26		3	1	0	1	4	7	0	3	1	4.2		
27		2	3	0	0	6	4	3	0	2	4.05		
28	SGS	0	0	0	0	1	2	6	7	4	6.55	6.850 ± 1.005	6.375
29		0	0	0	0	0	1	5	8	6	6.95		
30		0	0	0	0	0	2	3	7	8	7.05		
31	SGE	0	0	0	0	0	0	0	4	16	7.8	7.850 ± 0.360	6.777
32		0	0	0	0	0	0	0	3	17	7.85		
33		0	0	0	0	0	0	0	2	18	7.9		

Continued...

[12] Data has been adapted from Gould (2005) and Gould (2010)

Table 3: Table of responses and means for SLIM (continued)

Question # and Factor		Number of responses per Likert scale element									Question Means	Factor Response Mean ± σ	Expected Values
		0	1	2	3	4	5	6	7	8			
34	RC	1	0	0	0	1	3	4	3	8	6.4	6.317 ± 1.864	6.476
35		1	0	0	0	2	2	6	5	4	6.05		
36		1	0	0	0	0	2	4	8	5	6.5		
37	FR	13	0	0	0	4	0	1	1	1	1.85	0.950 ± 2.012	0.824
38		18	0	0	0	2	0	0	0	0	0.4		
39		17	0	0	0	3	0	0	0	0	0.6		
40	GAT	0	0	0	0	0	0	0	8	12	7.6	6.650 ± 1.764	5.535
41		0	0	0	0	0	0	2	9	9	7.35		
42		1	0	2	0	7	0	4	4	2	5		
43	GAC	0	0	0	0	0	4	6	9	1	6.35	6.067 ± 1.376	4.893
44		1	0	0	0	3	4	7	3	2	5.55		
45		0	0	0	0	2	3	6	5	4	6.3		
46	GMA	0	0	0	0	2	0	3	7	8	6.95	6.550 ± 1.501	4.704
47		0	0	0	0	1	0	4	6	9	7.1		
48		0	1	0	1	2	4	6	4	2	5.6		
49	UE	0	0	0	0	1	1	1	9	8	7.1	6.733 ± 1.494	5.171
50		0	0	0	2	0	2	1	7	8	6.75		
51		0	0	1	1	1	2	2	8	5	6.35		
52	IDE	0	1	1	0	3	7	5	1	2	5.15	5.533 ± 1.467	5.653
53		0	0	0	0	5	6	3	4	2	5.6		
54		0	0	0	0	4	4	5	5	2	5.85		

$X^2 = 2.932$

Degrees of freedom = (18-1)*(2-1) = 17

Calculated value of P using Microsoft Excel 2010 = 0.0001

Appendix J. Responses to the Leisure Motivation Scale (LMS)

Table 4 : Table of responses and means for the LMS

Question # and Factor		Number of responses per Likert scale element							Question Means	Factor Response Means	Standard Error
		0	1	2	3	4	5	6			
5	A	17	1	1	1	0	0	0	0.30	0.300	0.095
12		17	1	0	1	1	0	0	0.40		
19		17	1	0	2	0	0	0	0.35		
26		18	1	1	0	0	0	0	0.15		
1	EM-ER	15	3	0	2	0	0	0	0.45	1.212	0.179
8		13	4	0	2	0	1	0	0.75		
15		4	5	3	5	2	1	0	1.95		
22		8	5	0	2	3	1	1	1.70		
7	EM-IR	11	1	2	3	1	2	0	1.40	1.825	0.218
14		5	1	4	2	1	3	4	2.90		
21		10	5	1	3	1	0	0	1.00		
28		6	3	3	3	4	0	1	2.00		
3	EM-ID	3	6	0	3	4	3	1	2.60	2.800	0.228
10		4	4	1	4	3	2	2	2.60		
17		3	4	0	4	5	3	1	2.85		
24		5	1	2	2	2	4	4	3.15		
4	IM-S	2	4	2	3	3	4	2	3.05	3.100	0.221
11		5	2	1	0	5	6	1	3.00		
18		4	2	0	4	5	2	3	3.10		
25		0	6	1	3	3	6	1	3.25		
6	IM-A	1	1	2	0	3	7	6	4.40	4.013	0.209
13		3	1	0	3	4	7	2	3.65		
20		2	1	1	3	3	6	4	3.90		
27		1	1	2	4	1	5	6	4.10		
2	IM-K	1	0	0	1	1	6	11	5.15	4.913	0.174
9		1	1	0	0	3	7	8	4.80		
16		0	0	3	0	2	3	12	5.05		
23		1	1	0	2	1	8	7	4.65		

ANOVA statistic to verify the independence of the results between all questions:

$$F_{(21,532)} = 1.403, P = 0.110$$

Nested ANOVA statistic to verify the independence of the results between the categories of questions:

$$F_{(6,532)} = 69.621, P < 0.001$$