Archaeological Science Communication on YouTube: Inventorying current archaeological communication and representation on YouTube

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1. **November / ~~March~~**: start of the supervisory classes. Students will have to choose a subject.
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3	May 2022	Feedback on the first versions	
4	June 2020	Submission of the final version	

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Archaeological Science Communication on YouTube

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Inventorying current archaeological communication and representation on YouTube

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1. Introduction

The communication of archaeological information to the general public is arguably one of the most important aspects of archaeology. In general, the contemporary scientific archaeological discipline cannot exist without the much needed public interest and funding. It is therefore important that we as archaeologists find effective methods of clearly communicating archaeological information in ways that appeal to the general public. Science Communication studies is the study that examines and analyses the different methods of communicating scientific information. When referring to science communication, it is important to acknowledge and address the many different mediums scientific information can be conveyed through.

The internet has significantly altered the playing field in comparison with the traditional mediums of science communication, which include radio, television, and newspapers. The internet has equipped its users with the freedom to find and select from the unlimited quantity of information available to them. Furthermore, users on the internet are often able to provide direct feedback on content, in the form of commenting, liking/disliking and subscribing/following. Finally, all users are able to upload and share content on the internet for all other users to access. As for the last decade, the internet and social media platforms have become increasingly more dominant in the dissemination of information, and as a result, science communication is gradually shifting its focus towards these new and digital sources of information and forms of public interaction.

One online social media platform in particular, YouTube, has gone through significant development over the past years and will be the main focus of this thesis. Previous studies on science communication on YouTube have primarily targeted videos and channels that communicate science in general. For instance, recent studies have examined the credibility of scientific news on YouTube (Michalovich & Hershkovitz 2020), have ranked the educational channels on YouTube (Tabdier & Shoufan 2021), have investigated the gender gap in YouTube science communication (Amarasekara & Grant 2019), and have analysed public responses to climate change on YouTube (Shapiro & Park 2014). Archaeological science communication is underrepresented, however. Some archaeologists are certainly experimenting with science communication on social media

platforms, such as Duckworth (2019) on YouTube and Caspari (2022) on Instagram, but there is a lack of data on the archaeological content that is currently available to the general public on YouTube.

Aim

This thesis aims to identify and critically analyse the different types of archaeological content currently available on YouTube. The research is centred around two main considerations related to (archaeological) science communication on YouTube that will be the focus of this thesis. The first consideration emphasizes that YouTube as a popular online platform could offer an effective environment to disseminate archaeological information, spread awareness of archaeological developments, and reach wide audiences interested in archaeology. The second consideration stresses the potential hazard to the integrity and authenticity of the archaeological discipline by content produced by non-scientific channels which are also available on the platform. Both considerations highlight the importance for the archaeological discipline of understanding the available archaeological content on YouTube.

Research Question(s)

The main research question of this thesis is as follows:

- *How are Archaeological channels on YouTube currently communicating archaeological science?*

The sub questions of this thesis are as follows:

- *Which channels upload and produce archaeological content on YouTube?*
- *What are the different types of archaeological content on YouTube?*
- *What is the purpose of archaeological channels on YouTube?*
- *How do archaeological channels interact with audiences on YouTube?*
- *What is the primary targeted audience of archaeological channels on YouTube?*
- *Who or what is managing archaeological channels and producing archaeological content on YouTube?*
- *How accurate and reliable do archaeological channels represent archaeology on YouTube?*

To answer the research questions mentioned above, an extensive data set of 80 different archaeological channels on YouTube is gathered.. Channels were coded with a series categories based on the content analyses of previous studies on science communication on YouTube. Furthermore, the archaeological channels on YouTube are interpreted through a theoretical framework of three different models of science communication: the Deficit Model, the Dialogue Model and the Participation Model. Additionally, the experiences and insights from two already established examples of science communication on YouTube will be used to recognize patterns in the data set as well as identify reoccurring issues and benefits related to science communication on YouTube.

Chapter overview

The second chapter of this thesis elaborates on the theoretical framework of science communication. The chapter defines three distinct models of science communication that each represent different directions in which information is moving between scientists and the general public.

The third chapter covers the basic principles of how YouTube functions. This chapter will discuss the different motives users of the internet have for consuming content on YouTube and participating on the platform. The chapter will conclude with the overall reliability of information on YouTube and how the platform addresses the dissemination of misinformation and disinformation.

The fourth chapter showcases two examples of scientific YouTube channels that are and have been communicating scientific information on the platform. The first channel is called *Ant Lab* and is managed by entomologist Adrian Alan Smith. The second channel is called *ArchaeoDuck* and is managed by archaeologist Chloë N. Duckworth. Both Smith and Duckworth have written and published their first hand observations from managing a scientific channel on YouTube. The aim of this chapter is to provide further insight into how scientific channels on YouTube function and how scientific YouTubers experience science communication on the platform, by discussing the observations made by Smith and Duckworth.

Chapters two to four in this thesis primarily focus on describing and examining important concepts for this thesis such as: science communication, YouTube and scientific YouTube channels. From chapter five onwards, I will use these concepts to academically approach and investigate archaeological science communication on YouTube. Unfortunately, archaeological science communication on YouTube is a topic that is still relatively underdeveloped and rarely mentioned in academic literature. Therefore, chapter five will discuss several former studies that have researched (aspects of) general science communication on social media platforms, such as YouTube. The aim of this chapter is to analyse the various methodologies that have been used by the former studies in order to better understand general science communication on social media platforms, and help construct a methodological framework that will be used in this thesis.

Chapter six describes the methodology of this thesis that was used to examine the existing archaeological channels and archaeological science communication on YouTube. The chapter contains an in-depth overview of each coding category and can be used as a guide of reference for the extensive table located in the Appendix (chapter 13), which features the results of the proposed methodology.

Chapter seven summarizes the results from each coding category based on the contemporary (scientific) archaeological content on YouTube. The entire data set featuring all results can be found in the Appendix (chapter 13).

Chapter eight will analyse the results from each coding category and provide noticeable examples, in the form of archaeological YouTube channels, to illustrate the patterns from the data set.

Chapter nine will combine the different concepts, conclusions from former studies and the results of this study to discuss the communication of scientific archaeological information on YouTube.

The Conclusion, Abstract, Reference List, and Appendix can be found correspondingly in chapters ten, eleven, twelve and thirteen.

2. Science Communication

Defining Science Communication

The knowledge acquired through the work of scientific disciplines is often regarded as a great, if not essential, addition to the functioning of our society. For instance, policy makers rely heavily on the information provided by scientists. New technologies provide opportunities to overcome the issues and challenges we face, think of medical treatments or new approaches to climate change. Additionally, science can improve our overall quality of life by giving us access to our cultural past or by connecting us to people across the globe. All in all, science serves a fundamental role in our society and it is therefore crucial that science is accurately represented and understood. To fulfil this purpose, science communication aims to connect scientific disciplines with the general public. It studies the forms of communication between the two entities and aspires to establish or enhance this communication for the benefit of all participants of science communication.

The above definition of science communication is still relatively broad and does not consider the many complexities (and issues) that are related to science communication. When exactly do we speak of a relationship or connection between science and the general public, and how does such a connection take form? As will become clear later in this chapter, science communication appears in numerous forms which makes it difficult to exactly determine science communication. To avoid this issue, an alternative definition of science communication is proposed by Burns, Connor and Stocklmayer (2003) who do not identify science communication based on its occurring format but instead define it by its underlying purpose which involves the creation of personal responses from the public towards science.

This definition of science communication is centred around defining the purpose of science communication in which science communication is viewed as a continuous process that aims to produce personal responses to science (Burns *et* al 2003, 191). According to Burns *et al*. there are five types of personal responses to science that make up the purpose of science communication. These personal responses are listed under the analogy AEIOU (Burns *et* al 2003, 190):

1. Awareness of science;
2. Enjoyment or other affective responses to science;
3. Interest in science;
4. The forming, reforming or confirming of science-related Opinions (or attitudes);
5. Understanding of science

These five personal responses are to be considered the results of actively performing science communication within the field. Note however that each of these responses should not be viewed exclusively from each other, nor should all be viewed as requisite to science communication. Instead, science communication is defined as resulting in one or more of these personal responses to science from the general public. To illustrate, one can perform science communication by promoting science to the general public with as primary aim to increase public awareness of science (personal response 1). Some individuals within the general public may experience the form in which the information is presented as entertaining (personal response 2) or perhaps as interesting (personal response 3). How science communication affects the general public is of course dependent on a variety of factors such as the method of science communication, the subject or the information that is communicated, as well as the individual themselves and how they (are able to) interact with science communication.

Due to the variety of factors related to the outcomes of science communication as well as the personal responses to science, the field of research cannot restrict itself to quantitative methodologies solely when evaluating science communication. Burns *et al.* describe personal responses to science as ‘‘*more personal and immediate, and therefore more dynamic’’*, compared to the physical outcomes of science communication, for instance, the transfer of scientific information (Burns *et al* 2003, 185). Therefore, a combination of qualitative and quantitative methodologies is required to assess science communication, as is employed in this thesis (see chapter 6. Methodology). It should become clear that science communication is not the straightforward transfer of information from scientists to laypeople. Instead, science communication is much more complex and includes many different variables and responses that impact the outcomes of science communication. Science communication as a field of study aims to understand

the various aspects associated with the communication of science between the two groups in order to improve the overall effectiveness of science communication activities.

Modelling Science Communication

As was already touched upon briefly, science communication appears in numerous forms and capacities with each possibly resulting in different outcomes or personal responses to science from the general public. For example, nowadays, the publishing of a new scientific discovery, say the identification of a new species or a ground-breaking theory regarding Neolithic burial practices, can be accomplished by reaching out to the general public through a newspaper article, a post on a social media platform, or an article in a (scientific) magazine. Each of these formats function with distinct variables that influence the way the public is reached. Generally speaking, a post on a social media platform is shorter than an article in a newspaper or (scientific) magazine. The use of language is in each format different as they have to appeal to a different audience. Scientific and disciplinary jargon is presumably more suitable in a scientific magazine whereas a newspaper article or social media post will be more successful at reaching the public when such jargon is avoided. Additionally, think of the audio/visual formatting of the publication. Paperback newspapers and magazines lack the possibility of employing audio and video type formats while online publications have much more freedom in this aspect. In short, the diversity in which science communication situates, has resulted in a colourful pallet of communication forms of which each is able to reach the public in various ways and numbers.

There are two main theoretical models of science communication: the traditional Deficit Model and the subsequent Dialogue Model (also referred to as the Contextual Model (Burns *et al* 2003, 189-190)). Both models represent a different approach to communicating science to the public based on how the public is perceived and its role related to the scientific discipline. Although the latter Dialogue Model was initially a response to the former Deficit Model, it should not be considered as an opposing method of science communication but rather as an alternative model with its own drawbacks (Trench 2008, 1-2).

The Deficit Model

According to the Deficit Model, the public is deficient in scientific knowledge and should therefore be informed about science from the scientific community in order to obtain the lacking knowledge it requires. The model assumes that the public does not (fully) understand the science field itself and therefore places the scientific community in charge of science communication (Burns *et al* 2003, 189). Within the Deficit Model, science communication is asymmetrical (Burns *et al* 2003, 190). It is a top down, one directional, approach to science communication (Trench 2008, 1) in which the public is merely the receiver of scientific information and knowledge. In terms of examples, the previously mentioned newspaper article fits this model adequately. Here, the public receives scientific information by reading the newspaper article. Because of the newspaper format, the reader does not have the opportunity to respond to this information or interact with the communicator. Thus, the communication is one directional. Other examples that fit this model of science communication are books, or television and radio programmes.

The Dialogue/Contextual Model

The Dialogue Model takes a different approach to science communication compared to the Deficit Model. As the name of the model already implies, the public plays another role in the communication of science, one that allows it to communicate back to the scientific community. Therefore, the scientist and the general public are both sending and receiving information. As a result, science communication according to the Dialogue Model is symmetrical in which information moves into two directions (Burns *et al* 2003, 190). The general public still receives scientific information from the scientific community. However, the scientific community now also receives information from the general public. For instance, on how it understands and receives the initial information, as well as the ideas and personal responses that are generated from the public. In the Dialogue/Contextual Model, the context in which the information is situated is central whereas in the Deficit Model the information itself is paramount (Bubela *et al* 2009, 515). Suitable illustrations of science communication according to the Dialogue Model are referendums, citizen juries, and citizen science projects.

Other examples of the Dialogue Model are situated on the internet. In the past couple of decades, the internet has rapidly transformed our ability to access information as well as communicate with other people around the globe. The internet has provided the general public with nearly unlimited accessibility to information which also includes the information provided by the scientific community**.** The internet has allowed the general public to become involved with science and respond to science communication (Bubela *et al* 2009, 514). For instance, through interacting with scientists in comment sections, or by leaving a like or dislike. The form of science communication discussed in this thesis, science communication on YouTube, can be attributed to this model as well although there are some reasons to question this (see below). On YouTube, the user can obtain (scientific) information by watching videos on the video sharing platform. Moreover, the user can communicate with other users on the platform, including the uploader of the video, through the comment section underneath each video.

Comparing the models

During the 1980's and 1990's, the traditional approach to science communication, the Deficit Model, started to shift towards a different approach that would impact the relationship between the public and the scientific community. One that would metaphorically close the distance between scientists and the general public by stimulating open debate and discussion with the general public regarding science communication (Trench 2008, 2). This new approach would essentially become the Dialogue/Contextual Model. It was a response to the Deficit Model based on a common critique associated with the traditional approach which is that the Deficit Model does not consider the many complexities and factors that influence individual decisions and opinions. These elements include ideology, social identity, and the level of trust of the individual as well as competing influences from the entertainment industry, such as false portrayals by pop culture (Bubela *et al* 2009, 515). Thus, in contrast to the Deficit Model, the Dialogue/Contextual Model aims to better understand the context in which science is communicated. This also includes understanding the general public itself. By studying and addressing the feedback it receives from the general public, the scientific community can improve their strategies of science communication. This can ultimately result in benefit

for both parties. Namely, science communication becomes more effective at reaching its audience and the general public more specifically receives the information it requires. Additionally, the general public has the opportunity to ask questions of their own which could in turn result into new directions of research (Fischhoff & Scheufele 2013, 14031).

Despite the fact that this approach appears to be very beneficial for both the general public and the scientific community, the Dialogue/Contextual Model is not exempt from its issues and challenges. One of these issues is the framing of the information that is disseminated. Following and understanding scientific debates can often be difficult for the general public, especially if the topic is complex or requires extensive scientific background or knowledge in the field. The issue can be resolved by framing the information in such a way that the general public is able to understand and follow the current debate. This, however, can come at the cost of the accuracy of the information. Specifically, when considering the socio-political atmosphere in which information is often disseminated, information can be framed by a variety of media outlets in order to appeal to their audiences. The framing of information, for instance by heavily weighing in on only one side of a debate, can result in the undermining or even contradicting of the outcomes of scientific research (Bubela *et al* 2009, 515).

Another issue related to the Dialogue/Contextual Model is the democratic nature of the approach. According to Durodié (2003), allowing the general public to decide the legitimacy of scientific research, in the form of dialogue, can significantly impact the overall status of science. This is especially true when non-scientific information is preferred over scientific information by the general public. Whether scientific information is legitimate cannot (and should not) be determined by a democratic process, Durodié argues. This issue extends to the online aspect of science communication as well. Where it is true that the internet has provided us with nearly unlimited access to all sorts of information, not all available information on the internet should be regarded as scientific or accurate. As was discussed before, information can be framed or biased to appeal to a certain audience. Due to the immensity of available information available on the internet, it is up to the individual which information they want to receive and which information they wish to avoid. As a result, the availability of scientific information on the internet,

despite its quality or accuracy, does not guarantee its consumption (Bubela *et al* 2009, 516-517).

A third approach to Science Communication

So far in this chapter, I have elaborated on some of the aspects related to the two main but different approaches to science communication in general. However, when we closely examine science communication on social media platforms, such as YouTube, an important element is unaddressed by both the Deficit Model and the Dialogue/Contextual Model. The element I am referring to here is the possibility for the general public to execute science communication on their own. This is made possible by the fact that YouTube allows every user to create and upload their own content on the website. Therefore, every user can share and communicate (scientific) information to other users on the platform through video format. Trench (2008, 11) acknowledges this third approach to Science Communication and refers to it as the Participation Model. This model shares some similarity with the Dialogue Model. For instance, in both models, the general public plays an active role in the communication of science. In the Dialogue Model, the general public is consulted on science related issues and on how the scientific community can improve its communication strategies with the general public. In the Participation Model, every participant, including the general public, can effectively contribute to and critique science and its communication. This essential element that compliments both the models is also the aspect that sets these two models apart. Key to notice in the Participation Model is the distinct level of participation that is not fully associated with in the Dialogue Model.

Base communication models	Ideological and philosophical associations	Dominant models in PCST	Variants on dominant PCST models	Science's orientation to public
Dissemination	Scientism Technocracy	Deficit	Defence Marketing	They are hostile They are ignorant They can be persuaded
Dialogue	Pragmatism Constructivism	Dialogue	Context Consultation Engagement	We see their diverse needs We find out their views They talk back They take on the issue
Conversation	Participatory democracy Relativism	Participation	Deliberation Critique	They and we shape the issue They and we set the agenda They and we negotiate meanings

Figure 2: Three models of Science Communication (Trench 2008, 11)

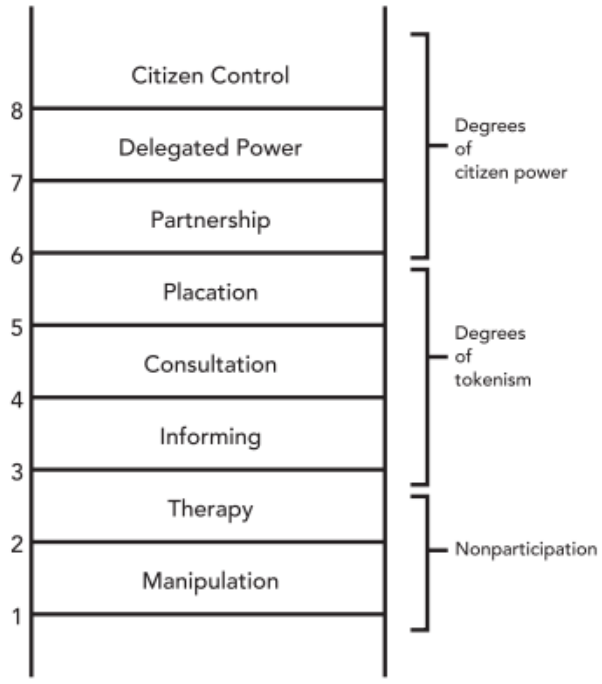


Figure 1: Arnstein's Ladder of Citizen Participation (Arnstein 2019)

To understand the varying levels of participation we must shift our focus to yet another model, which is Arnstein's Ladder of Citizen Participation (Figure 2) (Arnstein 2019). The ladder is designed by Arnstein to visualize and order the different levels of participation at which political power is distributed. The general idea is that the higher up in the ladder, the more political power the participant has over a specific subject. In terms of this thesis, this is the amount of power an individual has in the communication of archaeology on YouTube.

A noteworthy difference is noticed between the Dialogue Model and the Participation Model, regarding the participation ladder. In the Dialogue Model the participant is being informed about scientific information as well as consulted about its communication and dissemination. Although methods of science communication are often in practice more complex and variable we can more or less assume that the approaches related to the Dialogue Model are located on third and fourth step of Arnstein's participation ladder: 'Informing' and 'Consultation'. In the Participation Model, the participant has much more control and power over the communication of science, and perhaps ultimately, its contents too. According to Trench (2008, 11-12), the participant's orientation to science is on par with the scientific community (Figure 1). This places the approaches to science communication related to the Participation Model higher up in Arnstein's ladder, for instance, on the seventh and eighth step, 'Delegated Power' and 'Citizen Control'. Thus, what sets the two models apart from each other is the level of participation the general public has in the process of communicating science.

Science communication cannot exclusively be approached by quantifiable data but instead also requires a deeper analysis of its context (Burns *et al* 2003, 185). In this chapter, I have discussed and elaborated upon the three models of science communication and Arnstein's ladder of citizen participation. The reason I highlighted these models is because they form an analytical framework which can help us understand the complexity that is often attributed to science communication, especially when examining a non-transparent and extensive platform such as YouTube. Although the models cannot fully represent the reality that is archaeological science communication on YouTube, they can certainly help us understand archaeological science communication on YouTube and the relations between the different users on the platform. In this thesis, I

propose a methodology that both examines the relations between the archaeological field and the general public on YouTube through the specified analytical frameworks as well as observe and document the contextual elements from the various YouTube videos and channels related to archaeology. Thus I aim to better understand archaeological science communication on YouTube by combining quantitative and qualitative types of data.

3. YouTube

The main focus of this chapter will be to examine YouTube as the primary context in which the archaeological science communication documented in this thesis is located. Context can provide us with relevant information that affects the object of study or perhaps with new perspectives on how to interpret and understand the object of study. Therefore, if we wish to analyse archaeological science communication on YouTube, we first need to become more aware of its context, on how YouTube as a social media platform operates and how it is perceived by its users.

In simple terms, YouTube can be defined as the largest social media platforms in the world where people can watch, like, share, comment and upload their own videos (www.webwise.ie). YouTube is primarily a video sharing platform, meaning that the content that is shared on the platform are mainly videos, uploaded by the users of the platform. As is stated by YouTube itself, the platform's mission is to 'give everyone a voice and show them the world' (about.youtube). Although this statement might be interpreted as overly optimistic, it does capture one of YouTube's most essential features which is the opportunity for every user to freely upload video content of their own and share it with the rest of the world.

Originally founded in 2006, YouTube has expanded its reach substantially and has grown to become one of the most popular social networks in the world. According to Statista.com, YouTube counted a total number of 2,562 million monthly active users on January 2022. In comparison, the largest social network in the world, Facebook, counted a total number of 2,910 million monthly active users on January 2022, making YouTube the second largest social network in the world (www.statista.com). With such an extensive amount of users, and a broad variety of content, YouTube offers its users countless of videos to enjoy or to inform themselves with as well as an accessible platform on which its users can share and disseminate information, ideas and creative outlets. Therefore, YouTube could also contribute to the communication of (archaeological) science. However, before we can seriously consider this possibility, it is key to understand the user motives behind watching videos and engaging on the platform.

YouTube User Motives

One important study that examined the user motives for engagement and consumption on YouTube was done by M. Laeeq Khan (2017). In this study, Khan investigated the different motives behind engaging with and consuming YouTube content by questioning registered users of YouTube in an online survey. The dataset was compressed and summarized using descriptive analysis methods. The survey was aimed to gather demographic information from the sample size such as the user's gender, ethnicity and age. Additionally, Khan was interested in the personality of YouTube users, the amount of time each user spent on YouTube, their motivations behind watching content and also the motivations behind their participation on YouTube, for instance by liking and disliking content, writing comments, or by sharing or even uploading YouTube videos on the platform.

Ultimately, Khan identified five user motive categories for both YouTube consumption and participation:

1. Seeking Information
2. Giving Information
3. Self-Status Seeking
4. Social Interaction
5. Relaxing Entertainment

In the online survey the motive that occurred most frequently was motive 5, Relaxing Entertainment, followed by motive 1, Seeking Information, and motive 2, Giving Information (Khan 2017, 241). This suggests that users of YouTube watch and interact with the platform primarily to be entertained and secondly to be informed or to provide information to others. Therefore, YouTube can be considered primarily as a platform used as both a source for entertainment and information.

When taking a closer look at the first motive, Seeking Information, the results of Khan's study indicate that users with this motive are more likely to watch videos and read other user's comments (Khan 2017, 242). The statistics also indicate that the user with the Seeking Information motive searches for information in both the video and in the comment section. The information seeker is also prone to participate in comment

sections, for instance, by asking questions that may lead to the information the user was initially searching for (Khan 2017, 243).

The second motive, Giving Information, statistically predicts similar results. A user with the Giving Information motive will communicate information to other users by engaging with them in the comment section or by liking and disliking videos. Additionally, a user who is motivated by providing information to others is more likely to share and upload videos compared to a user who searches for information (Khan 2017, 243). The dissemination of information therefore not only takes places in the video itself but is often further elaborated upon in the comment section by the users of YouTube.

A noteworthy conclusion from Khan's study is that each of the motives represent a different user approach to the content available on YouTube. This in turn correlates well with the different approaches to science communication and public participation mentioned in the previous chapter (2. Science Communication). To illustrate, a user on YouTube who is providing information to others (motive 2), for instance by uploading informative videos, is actively communicating science on a high participatory level. Depending on additional factors, such as whether the user is a layperson or a scientific expert on the topic, the appropriate model of science communication can be attributed to the user who is providing information to other users. In contrast, a user who seeks information on YouTube (motive 1) by primarily consuming its content, in the form of watching videos and reading comment sections, is participating with science communication on a lower level of participation. Here information is mainly transferred in one direction as the user is only receiving information from YouTube, which correlates to the Deficit Model.

The idea that YouTube hosts diverse audiences with varying motives of content consumption and participation is further advocated by M. Thelwall and F. Vis (2012) who investigated the discussions and debates present on the platform. Their quantitative study examined numerous comment sections in relation to the topic of the video it belonged to. Commenters were analysed based on age, gender and location, whereas comments were analysed based on the number of characters, the positive or negative sentiment of the message and the number of replies. The study shows that the number of comments as well as replies on each comment is strongly dependent on the topic of a

video. For instance, topics such as Religion, Science & Technology, and News & Politics attracted much denser discussions compared to Music and Comedy videos (Thelwall & Vis 2012, 14). The study compliments the possibility of YouTube as a public platform for discussion as well as suggests the presence of a variety of users on YouTube with different motives and levels of interaction (Thelwall & Vis 2012, 15). Again, some users prefer to engage with YouTube more passively by watching video content and reading through the comment sections whereas other users can be associated with higher levels of participation through their engagement in comment sections or even the uploading of informative videos on YouTube.

To conclude, users of YouTube have varying motives when it comes to the consumption and participation of content on the platform. According to Khan's (2017) study, the most occurring user motive is entertainment (motive 5: Relaxing Entertainment). Still, YouTube should definitely also be considered as a source of information and as a platform to discuss and disseminate information with other users. For instance, the comment section is a beneficial tool in this regard, that allows the user to discuss the information or topic(s) mentioned in a video with other users. Additionally, I would argue that the comment section could potentially offer a platform in which the general public can formulate feedback to science, evidently closing the distance between the scientific community and the general public. Especially when considering the vast number of active users on YouTube, the influence of the platform on science communication is worthwhile to examine as it can provide opportunities to communicate archaeological science as well.

Reliability of information on YouTube

A major issue related to the dissemination of information on YouTube concerns the reliability of the information that is provided on the platform. Despite that YouTube states that preventing the spread of disinformation is one of its greatest responsibilities, according to critics, YouTube insufficiently addresses the presence of misinformation and disinformation on the platform (www.Trouw.nl). Although the freedom to publish any information on YouTube does align with YouTube's official mission statement, which describes its aim to provide everyone with a voice and the possibility to explore the

worldviews of other users (about.youtube), the resulting issue has recently come under substantial criticism from fact-checking organizations. One of these organizations is the International Fact-Checking Network (IFCN), who confronted the issue in an open letter directed at the current CEO of YouTube, Susan Wojciki. In this letter from January 2022, the IFCN refers to the rise of cross national conspiracy groups on YouTube, the dissemination of content that promote hate speech against vulnerable groups or provide false information related to medical cures or politics. All of the above made possible on the platform of YouTube as a result of a lack of effort to prevent this content from gaining further attention and following. Instead of deleting content containing false or harmful information from its platform, which has been the approach of YouTube so far, the IFCN proposes a number of alternative solutions to counteract the dissemination of misinformation and disinformation on YouTube. These solutions involve the structural debunking and fact-checking of information, publishing of information regarding how YouTube currently moderates disinformation and misinformation (misinformation is the spread of false information regardless of its intent to mislead whereas disinformation is a deliberate form of spreading false information), acting against known offenders and extending its attention to information provided in different languages than English (www.poynter.org).

The letter from the IFCN is primarily referring to the dissemination of misinformation and disinformation regarding election fraud, hate speech, conspiracy theories and other forms of fake news, which have caused harmful situations in the real world as well (www.bbc.com). However, the publication of false archaeological information on YouTube might just as well be considered as an unaddressed issue related to the dissemination of misinformation and disinformation, which can have severe consequences for the integrity of the archaeological discipline as well as the legitimacy of experts in the archaeological field. A divergent field and approach to archaeology that comes to mind is the field of pseudo-archaeology. Distinguishing academic archaeology from pseudo-archaeology on YouTube can prove to be difficult for the general public who do not have the expertise or knowledge to accomplish this. Pseudo-archaeology is often associated with the undermining of archaeological theory by simplifying complex archaeological questions and issues. This way, pseudo-archaeology is able to

accommodate to the general public with explanations for archaeological issues that are easier to understand for the general public and thus appeals to a larger audience. The simplified explanations of pseudo-archaeologists often fail to acknowledge (complex) scientific data that confounds their conclusions making it increasingly difficult for the general public to separate pseudo from academic archaeology (Bassett 2013, 61-62), also on YouTube. Therefore, if YouTube continues to insufficiently address the general issue of misinformation and disinformation, as was pointed out by the IFCN, it will also affect the archaeological discipline, as incorrect archaeological information, for instance in the form of pseudo-archaeology, will continue to disseminate inaccurate information on the platform that in turn will reach the general public.

One of the systems that YouTube employs to counteract the dissemination of misinformation and disinformation are Fact Check Panels. These panels appear above specific search results and provide the user with additional context, such as the publisher's funding, as well as articles containing fact checked information from third party publishers, in order to debunk possible misinformation. The fact check panels are drafted by authoritative publishers and official fact check organizations, including the IFCN and ClaimReview, to further prevent users on YouTube from engaging with misinformation. The fact check panel system however is, as of writing this thesis, still in a testing phase, relies substantially on an ambiguous algorithm, only targets historical and scientific topics that frequently involve misinformation and appears to be not even available in all countries and languages (www.youtube.com[1]). Thus, it is fair to argue that this system is also insufficient at preventing the dissemination of unreliable information on YouTube.

The recommendation system

The system currently active on YouTube that determines which content is presented to the user is generally known as "the algorithm". The algorithm is a string of computer code that predicts the content the user would like to watch next, based on a number of factors related to user's activity on platform. According to YouTube, the content recommended to a user is based on a variety of factors such as their watch and search history, channel

subscriptions, clicks, watch time, survey responses, and the videos the user shares, likes and dislikes (www.youtube.com[2]). Recommended content appears on YouTube's homepage and next to the video that the user is currently watching. The user can always search for content independently by using the search bar on top of the website or the user can click on the content that is suggested by the recommendation system.

YouTube states that the recommendation system is also a tool used by the platform to prevent the dissemination of false information on YouTube. The content that falls under this system does not necessarily violate YouTube's official Community Guidelines (www.youtube.com[3]), however is flagged as potentially harmful for the user and the platform. Low-quality content or harmful content containing misinformation is therefore not disseminated by the recommendation system, unless the user is subscribed to the channel that uploads the referred to content (www.youtube.com[2]).

The content that the user watches and is being recommended on YouTube is partly defined by the user's individual activity on the platform. Considering the nearly endless amount of content uploaded on YouTube however, not all available content will be watched by the user or even be recommended or revealed. The more content of a specific type a user consumes, the less likely it will become for the user to gain access to other topics and types of content. The same issue, in regard to the communication of science on online social platforms, was elaborated upon by Bubela *et al.* (2009). One of the main difficulties of science communication on online social platforms is related to whether the academic information is actually visible on the platform among the various other types of content, and whether the general public will be drawn towards this scientific content (Bubela *et al.* 2009, 517). Ultimately, individuals more often gravitate towards information sources that confirm their worldview and ideas (Bubela *et al.* 2009, 515). Distinctive types of information and content, for instance academic archaeology and pseudo-archaeology, are separated by the recommendation system and end up targeting different audiences. As a result, archaeological science communication becomes detached and fails to address the entire YouTube community interested in archaeology.

This effect is referred to as the Echo Chamber Effect. Echo chambers are defined as 'environments in which the opinion, political leaning, or belief of users about a topic gets reinforced due to repeated interactions with peers or sources having similar tendencies

and attitudes' (Cinelli *et al.* 2021, 1). The recommendation system of YouTube enables users to find the specific echo chamber that confirms their worldview or interests by recommending channels and videos that correlate with content previously viewed and liked by the user or the user's search history. Academic archaeology will therefore have to compete with other channels that present archaeological information on YouTube. These channels may communicate archaeological information in a much more entertaining manner, compared to academic archaeology. Or archaeological information may be simplified to an extend that it is no longer accurate or reliable, as is the case with pseudo-archaeology.

To conclude, the recommendation system functions as an interesting but complex mechanism that determines the content that individual users will be exposed to. In terms of (archaeological) science communication, the system acts as a double edged sword when it comes to connecting scientific information to the average YouTube user. On one hand, scientific information is systemically recommended to users who are interested in this content. On the other hand, scientific information often fails to reach other users on the platform. Therefore, in order to succeed on YouTube, the academic archaeological field will have to identify existing archaeological channels as well as understand their methods of communicating archaeology to the general public. Based on this information, the academic archaeological field can adjust their approach to communicating archaeology on YouTube and as a result, reach the general public more effectively.

4. Examples of Science Communication on YouTube

This chapter will be the introduction to two major examples of YouTube channels that communicate or have communicated scientific information on YouTube. In this chapter I will examine and discuss the channels *Ant Lab* and *Archaeoduck* based on the literature written by the respective channel owners Smith and Duckworth. Both scientists refer to numerous observations and experiences they made when producing scientific content on YouTube which are relevant to the research of this thesis. This chapter will start of by discussing each channel separately and will conclude with a short discussion related to the observations made by Smith and Duckworth.

Ant Lab

The first example of science communication on YouTube is the YouTube channel called *Ant Lab*. The channel is managed by entomologist Adrian Alan Smith who elaborated upon his experience in communicating science on YouTube and other social media platforms in an interview by de Correspondent (www.decorrespondent.nl). On his channel, Smith provides his audience with relatively short informal videos about different species of insects. The videos include close up shots and clips of the insects in high resolution(s) and oftentimes in slow motion as well, which partially resemble the approach used in *Planet Earth* documentaries. *Ant Lab* currently (March, 2022) has over 125 thousand subscribers on YouTube. The most watched video on the channel (Insects in flight | 11 incredible species in SLOW MOTION) currently has 3.7 million views.

In this interview, YouTuber and entomologist Smith presents a number of advantages that come along with communicating science on YouTube. Smith argues that traditional forms of science publication fail to communicate science to the public. The entomologist continues by referring to an example in which Smith published an article about a larva from a specific beetle species in *Plos One*, a scientific journal. The article was far from significant enough to appear in a journal with a high impact rate. Smith also made a video on YouTube about the same topic, which has at this moment over 164 thousand views and has resulted in people subscribing for more content (www.decorrespondent.nl). This brief example shows the impact and public outreach a video on YouTube can have

compared to an article in a scientific journal which is far less likely to receive (continuous) public attention.

However, it is not only the general public that watches the content on *Ant Lab*. Smith mentions that his channel is also viewed by other scientists. For instance, Smith came in contact through the comment section with another entomologist from Japan who recognized the behaviour from the larva from the previous example. Additionally, in a YouTube video about wasp stings, Smith was able to connect with dr. S.W.S Gussekloo, who is researching different designs of injection needles (www.decorrespondent.nl). In these examples, YouTube functioned as a platform where scientists with both similar and different specializations were able to find each other and share their ideas and research.

Smith refers to a change in both format and approach when communicating science through articles in scientific journals, aimed towards the academic community, compared to informal videos on YouTube, aimed towards the general public. Scientific articles are often well structured, complex, analyse every sample or aspect of the research and are unattractive to read (www.decorrespondent.nl). In a YouTube video, the focus is on the best or most interesting sample (www.decorrespondent.nl) and the information is brief and presented in a way that is attractive to the audience. In the case of *Ant Lab*, this is achieved by presenting an interesting topic supported by carefully selected footage.

Although the format on YouTube is still able to communicate scientific information, Smith admits that the scientific narrative is occasionally replaced by viewer suggested topics, which can result in videos that are less scientifically based. Video topics and scientific information are adjusted or left out to primarily appeal to the general public, leading to videos such as: *Does the snap of a trap-jaw ant hurt?* Smith also uses a camera that captures colours whereas most laboratories use a camera that only captures black and white. For research purposes, the latter camera is more than sufficient, however colourful footage is much more pleasing to watch for the general public (www.decorrespondent.nl). Smith purposively uses the former camera to appeal to his audience on YouTube and recommends other scientists to follow this approach. Therefore, the transition from scientific article to YouTube video causes the general public to have an impact on the communication of science as the content is partially influenced by the audience on YouTube.

Finally, Smith emphasises the importance of personally presenting the information in the video. When the viewer sees the scientist present their own research the viewer will more likely perceive the information as trustworthy. Additionally, the scientist can show the viewer their personal interest in the research topic which can further stimulate the viewer's curiosity (www.decorrespondent.nl). In the videos of *Ant Lab*, the audience is often looking at Smith as the camera switches back to him when he is providing the audience with information. As a result, the audience can connect a face to the scientist they are listening to. It is no longer the scientist who is hiding behind the camera but instead it is a human individual who is personally providing the viewer with (scientific) information, based on the research he or she has done.

In the interview, Smith argues for the potential of YouTube as a platform to disseminate scientific information and he uses his own channel and experience as an example of how scientific communication on YouTube could take form. Smith brings up a number of significant points that allow for scientific communication on YouTube to succeed such as the importance of appealing to your audience and presenting information personally. However, *Ant Lab* also showcases a potential drawback to science communication on YouTube which is its dependency on the audience, possibly at the expense of scientific authenticity. This is because the content on *Ant Lab* is partially influenced by its audience both concerning its structure and information. Here, the change in structure refers to the colour camera example and selecting the best sample. Information is impacted by topic requests from the audience and reducing the amount of detail and scientific jargon in the videos.

The extent to which science and science communication on YouTube are affected by the audience is in the case of *Ant Lab* arguably minimal. Apart from the video requests from the audience, the focus of the channel and its information are still primarily scientific and driven by Smith's research. The audience has only a minor impact on the uploaded content, for instance, in the form of feedback in the comment sections. *Ant Lab* should therefore be considered as a one-way approach to inform the public, and resembles the Deficit Model of science communication. Concerns about the authenticity of science as a result of increasing levels of participation and democratization from the general public are argued by Durodié (2003; see also: 2. Science Communication). According to Durodié,

science and scientific outcomes cannot be determined by a democratic process. Here, Durodié refers to methods of participation and dialogue between science and the general public, which are characteristic of the Dialogue and Participation Models of science communication. In the case of *Ant Lab*, the influence of the audience is limited which should have insufficient effect on science and the communication of science. However, with increasing levels of participation, this could potentially become an issue. An example would be a channel that cocreates content and (scientific) information with its viewers. On such a channel, the audience has more influence on the content and thus on science.

ArchaeoDuck

A second example of a YouTube channel that communicates scientific information is *ArchaeoDuck*. The channel is managed by archaeologist Chloë N. Duckworth, and was initially created as a response to the already existing archaeological and pseudo-archaeological content available on YouTube. *ArchaeoDuck* aims to provide the viewer with content that differs from the existing (non-)archaeological sources. Instead of focusing on archaeological sites and finds, *ArchaeoDuck* discusses archaeological theories and methods, as well as interviewing individuals who practice archaeology (Duckworth 2019, 191-192).

Equally important is how Duckworth defines her channel based on a definition created by Bonacchi (2017). According to Duckworth, *ArchaeoDuck* is a 'broadcasting' channel, and not a 'participatory' channel (Duckworth 2019, 190). The two types of channels are representative of two distinctive approaches to digital engagement, as described by Bonacchi. Bonacchi proposes the 'Broadcasting' Approach and 'Participatory' Practices to digital engagement. The 'Broadcasting' Approach is described as a one-way form of communication, in which information is communicated from the sender to the receiver. It is possible for the receiver to respond with feedback, however responses are usually restricted to functional information on how to improve the communication (of science). 'Participatory' Practices are different from the broadcasting approach as they allow for the general public to be actively involved and participate with digital engagement. Regarding 'Participatory' Practices, Bonacchi refers to different forms of participation

with the general public, such as collaboration, consultation and co-creation. The two approaches to digital engagement, proposed by Bonacchi, closely reflect the theoretical models of science communication and are likely a representation of this framework. For instance, Bonacchi's 'broadcasting' approach displays a strong similarity with the Deficit model of science communication, as they both represent a one-way flow of information. Duckworth identifying her YouTube channel as a 'broadcasting' channel indicates the direction in which the information is mainly transferred. Similar to *AntLab*, *ArchaeoDuck* is also receiving information in the form of general feedback from its audience. However, this is still characteristic of the 'broadcasting' approach, according to Bonnachi (Bonacchi 2017, 4), and therefore also of the Deficit Model of science communication.

One of the goals of *Archaeoduck* is to present the audience with the immense variability that is archaeology. Duckworth achieves this by interviewing various archaeologists and discussing different archaeological or heritage related topics. This way the audience is introduced to a more accurate and diverse representation of archaeology compared to the stereotypical 'Indiana Jones'-style misinterpretation of archaeology. The first video on *Archaeoduck* aimed to debunk these misinterpretations and was followed by subsequent videos in which archaeologists were interviewed to showcase their diverse personalities, perspectives and fields of study within archaeology. Additionally, *Archaeoduck* features many female archaeologists with diverse academic backgrounds and specializations in order to disprove the general assumption that archaeology is a masculine discipline (Duckworth 2019, 192-193).

Similar to Smith's approach on his channel, *Ant Lab*, Duckworth approaches her audience in a personal manner on *ArchaeoDuck*. This is both reflected in the video content as well as in the overall appearance of the YouTube channel. Duckworth is clearly visible in a majority of the thumbnails and is often talking directly to the audience. Moreover, the videos are edited by Duckworth herself resulting in the videos and channel appearing as more authentic and personal (Duckworth 2019, 191). Also the use of archaeological jargon is limited to better appeal to the general public. Duckworth mentions that the use of jargon is one of the main obstructions to communicating archaeological information. However, instead of avoiding complex terminology all together, Duckworth prefers to use contemporary examples or analogies that help explain complex aspects of archaeology

(Duckworth 2019, 194). All of the above elements are incorporated in the videos on *ArchaeoDuck* and allow archaeology to become (more) accessible to the audience.

Additionally, YouTube provides the audience with the opportunity to ask questions related to archaeology. Because users on YouTube are not obligatory to use their real name on their profile, users can interact with content without being (fully) identified by other users. Duckworth mentions that it is this sense of internet anonymity that grants her viewers the chance to ask questions they are too afraid to ask in other contexts (Duckworth 2019, 196). Archaeology is a wide and complex discipline that covers many subfields of study and practices. Not to mention the usage of scientific jargon that can further complicate archaeological science communication for the general public. Asking a professional archaeologist a question about archaeology can therefore be perceived as fairly daunting for someone without much or any knowledge of archaeology. Duckworth's personal approach to communicating archaeology combined with her usage of analogies to explain archaeological jargon and the online anonymity that users on YouTube enjoy make up for a strong formula that appeals to the audience and removes the barricades between archaeological specialists and the general public. Therefore, if managed appropriately by the channel owner, YouTube as a platform can add to the ability to learn from archaeological YouTube channels and engage or interact with the archaeological discipline.

Finally, Duckworth points out that actively maintaining *ArchaeoDuck*, both on YouTube and other social media platforms has put a significant amount of pressure on her, in terms of time, resources and the handling of criticism or even hostile feedback. To illustrate, the entire production process of a short video on YouTube may take up multiple days, which excludes the time and effort required to read through and respond to viewer comments. Duckworth refers to the academic need of presenting itself and science on (online) social platforms whilst failing to compensate or sufficiently support professionals and academics who are actively involved in disseminating scientific information on such platforms (Duckworth 2019, 198). For instance, academic institutions could assist professionals and academics by offering training programs that help deal with overwhelming negative or hostile feedback online, or provide resources and time to be able to actively maintain a YouTube channel and produce videos consistently. Smith from *Ant Lab* acknowledges that

science is far too often still failing to reach people beyond the exclusive academic community, and that YouTube offers a favourable opportunity to expand on public outreach. However, producing YouTube videos that successfully disseminate scientific information on the platform requires experience in the field and a different type of knowledge on how to effectively approach the general public on YouTube (www.decorrespondent.nl). In order to further stimulate academic science communication on YouTube, additional research on the topic is required, as well as a change in the attitude of academics and academic institutions towards the possibility of communicating science on social media platforms. With the support of such institutions, more academics will be able to explore this field and share scientific narratives with the general public.

In conclusion, this chapter examined two different existing YouTube channels that communicate science to the general public. As became clear in this chapter, *Ant Lab* and *ArchaeoDuck* both share a number similarities. The channels have figured out a successful approach to communicating science on YouTube as well as interacting with the general public. Each of the channels can be identified as a broadcasting channel, which means that they provide their audience with scientific information mainly in one direction, as is characterized in the Deficit Model of science communication. YouTube as a platform allows the viewers to interact with the channel owner and the information they provide, however their direct influence on scientific research is severely limited. In order to appeal to a larger and less professional audience, the channels had to adjust their language and overall content, which make for an interesting case in which the transmitter of information has to find a balance between scientific accessibility and authenticity, and public interest. On top of that, these channels need to compete with non-academic channels on YouTube. With limited amounts of resources and time, most individual academics will find it extremely difficult to successfully communicate science on the platform. It is therefore safe to say that executing science communication on YouTube is complex and requires a lot of effort, experience and motivation from the individual academic. Nonetheless, *Ant Lab* and *Archeaoduck* have proven that it is not impossible and that their approach to communicating science has the potential to reach a wider audience by making science more accessible to the general public.

5. Former Research on the Communication of Science on Social Media platforms

Science communication on YouTube and other social media platforms has become increasingly more relevant in the last decade due to the growing importance and usage of the internet. Gradually, the scientific field is realizing the potential of disseminating scientific information on social media platforms, as more literature and studies on this topic are being presented, including this thesis. This chapter will discuss a number of these studies in order to better understand general science communication on social media platforms, and help construct a methodological framework which will be used in this thesis to investigate archaeological science communication on YouTube.

Archaeology on Instagram

The first study examined in this chapter focuses on archaeological science communication on another popular social media platform: Instagram. In this study, Caspari argues that due to the pandemic, educational activities have transitioned from a real world environment towards virtual spaces. The influence of online platforms has become more prevalent and scientific disciplines, including archaeology, are slowly moving their attention towards communicating science online, such as on Instagram. Still, scientific representation on Instagram appears underwhelming and is generally superseded by pseudo-scientific accounts (Caspari 2022, 1).

Caspari investigated contemporary archaeological science communication using two distinct analytical approaches. The first approach involved examining different hashtags, in multiple languages, all related to archaeology, for instance #archaeology, #archaeologists, and #archaeologylife. The hashtags were counted twice with a time frame of 18 months in between, to show a rise or decline of archaeological representation on Instagram. Each hashtag demonstrated a considerable growth in usage (Caspari 2022, 3-5). The second approach involved the examination of a single account that accomplishes archaeological science communication, which is Caspari's own Instagram account called:

@ginocaspari. Caspari collected data on the audience demographics, account size and followers, account reach, engagement rate and individual polls on the account which referred to the account's archaeological reliability and effect on the public's perception and interaction with archaeology.

Based on Caspari's personal experiences with communicating archaeology on Instagram and the results of this study, Caspari provides a multitude of arguments that closely resemble the conclusions from previously mentioned scientific YouTubers Duckworth (*ArchaeoDuck*) and Smith (*Ant Lab*) (see chapter 4. Examples of Science Communication on YouTube). Caspari mentions a 'trade-off between reaching a wide audience and staying true to scholarship' (Caspari 2022, 5). Online science communication can often prove to be difficult as it has to appeal to the general public's interest in order to remain visible on the platforms whilst holding on to scientific values. It refers to the dualistic nature of online science communication which is also experienced by Duckworth (Duckworth 2019, 193) and Smith (www.decorrespondent.nl). Furthermore, Caspari argues against the effectiveness of institutional accounts on social media platforms and prefers accounts managed by individual researchers to communicate science (Caspari 2022, 6). As also critiqued by Duckworth (Duckworth 2019, 197)**,** individual researchers generally lack the resources and time to fully dedicate to online science communication, especially when compared to institutional organisations. However, individual researchers are more likely to establish a personal connection with their audience and a personal perspective or worldview on science (or read: archaeology). These two factors build up trust between the researcher and their audience and a sense of reliability regarding presented scientific information (Caspari 2022, 6; Duckworth 2019, 196), which is favoured by users of Instagram and is even able to reach users who interact, or have previously interacted with pseudo-archaeological accounts (Caspari 2022, 6). Therefore, individual researchers provide a more sustainable form of online science communication that allows for (personal) interaction from the audience and which is perceived by the general public as more reliable.

Analysing Gender division in science communication on YouTube

The second study of this chapter investigated female presence and popularity among YouTube channels that communicate science on the platform. Amarasekara and Grant

(2019) propose a quantitative analysis based on the representation of female hosted channels, subscriber and viewer count from a sample of channels, and detected sentiment towards the channel host in the comment sections of featured videos. The sample was restricted to STEM (Science, Technology, Engineering and Mathematics) channels and consisted out of a total of 391 channels. Each channel was identified based on the gender or video style of the channel under the categories: Female Host, Male Host, Team Host, Female voice-over, Male voice over, and Neutral. Subsequently, the number of views, subscribers, likes/dislikes, and comments were documented from each channel (Amarasekara & Grant 2019, 72-73). The study also describes a sentiment analysis in which the comments of the sampled channels were analysed and categorized based on the nature of the comments directed towards the channel host and/or content. With this data, the sampled channels were compared on various factors that contributed to their representativeness, popularity and the audience sentiment towards the channels. Averages of the data were calculated and presented in bar charts and box-plots. To illustrate, one of the conclusions from the study revealed that female hosted channels showcase a significantly higher subscriber rate to comments compared to all other gender categories (Amarasekara & Grant 2019, 75).

The analytical framework presented by Amarasekara & Grant (2019) proposes mostly a quantitative approach to analysing channels on YouTube and results in a clear overview of the data. This approach can be applied for different research purposes by exchanging the gender related categories for categories more relevant to the research project. The study however fails to address qualitative forms of data which could prove essential to understanding the variety of archaeological science communication on YouTube.

Categorizing Science Communication Videos

As the internet is becoming a more meaningful platform for communicating science, the original format in which science communication is presented is being subjected to a number of fundamental changes. For example, the transition from television to internet has influenced the (archaeological) science communication significantly. Whereas the internet and television both provide the audience with an audio-visual form of science

communication, the internet also allows viewers to interact with the content and share it with other users through weblinks. As a result, videos on the internet can become viral, meaning they are disseminated widely by internet users over various online platforms (De Lara *et al.* 2017, 1-2). Another important distinction between internet and television is the ability of the internet user to freely participate in content creation. Content on television, including science communication, is controlled and produced by professional television organizations and journalists. In contrast, content on the internet is mostly created by users of the internet, who are not necessarily professional (De Lara *et al.* 2017, 2). This fundamental difference in content is categorized under User-Generated-Content (UGC) and Professionally-Generated-Content (PGC).

In order to better understand the transition of science communication from television to the internet, De Lara *et al.* (2017) examined the different formats of science communication uploaded on the internet. De Lara *et al.* focused on the science communication of climate change. The paper analysed a sample of 300 videos from social media platforms and websites and categorized 18 different format types, 9 for TV formats, and 9 for Web formats. The Web formats included format types such as the Video Blog, Web Music video, and TV debate. Additionally, the videos were categorized based on a number of interesting variables which included the number of views and comments, UGC or PGC, aim of the video, use of scientific terminology, and the level at which the viewer was encouraged to interact with the content (De Lara *et al.* 2017, 7-8). The study suggests a wide variety of format types on the internet which include format types originally produced for television as well as format types created for the internet. Most videos from the sample were of the latter category. The study also suggests that most videos from the sample size do not fully embrace the potential for interactivity that the internet offers. The use of scientific jargon was scarce.

Bonacchi *et al*. (2013) also examined the differences between videos on television and the internet. This study focused on the audio-visual content of archaeological science communication in the United Kingdom. Bonacchi *et al*. notice a distinctive level of professionalism when comparing audio-visual content from the two platforms. Online videos, for instance on YouTube, often embrace a more casual approach and allow for public engagement with archaeology. This does not exclude archaeological organisations

from being present online. In contrast, archaeological organisations, such as museums and commercial archaeological institutions, use videos on the internet to create a dialogue with the tax paying public, as a way to engage and address the funders of archaeology (Bonacchi *et al.* 2013, 58).

Bonacchi *et al*. examined several web-based videos and YouTube channels of archaeological institutions and organisations in the United Kingdom. Examples of the former include the British Museum, Wessex Archaeology, and the National Gallery. The online videos varied greatly in terms of length, degree of dynamism, production values, type of content, and usage and interaction (Bonacchi *et al.* 2013, 58). The last category was measured based on the number of views and subscribers or followers. The study shows that videos with a high production value and a short duration were most popular on web-based platforms. Casual users of the internet are usually not looking for extensive (archaeological) videos and will be more inclined to watch shorter videos instead. Secondly, the study shows that the analysed online videos and YouTube channels from archaeological organisations fail to attract a wide audience and often maintain a small number of subscribers, especially when compared with the online content from entertainment channels (Bonacchi *et al.* 2013, 59). The study acknowledges the rising importance of the online environment, also for science communication, and therefore advocates that adequate branding is required in order for online archaeological channels and videos to be effective (Bonacchi *et al.* 2013, 60-61). This conclusion showcases the minor archaeological niche within the significantly larger online environment of information and entertainment. Still it must be noted that Bonacchi *et al*. (2013) primarily focused on web-based videos and channels from archaeological organisations and have not addressed user generated content (UGC) of archaeology, such as the previously mentioned YouTube channel *ArchaeoDuck* and the Instagram account *@ginocaspari*.

The Mesolithic on YouTube

Another relevant study is a Ph. D. thesis by Henson (2016), concerning the science communication of the British Mesolithic. As part of this thesis, Henson examined a sample of 50 videos on YouTube that appeared when using the search term ‘Mesolithic’. Henson

identified multiple types of video producers, both UGC and PGC, which included individuals, universities, educational organisations, and broadcasters. A majority of the analysed videos had an educational purpose as opposed to the other videos that primarily aimed to entertain the audience. One of the educational videos was referred to as having a highly entertaining style. Henson mentions a wide variety of video formats such a video blogs, animations, presentations, narrative driven videos, filmed museum or site visits, and even a music video. Furthermore, these videos vastly differentiated in the country of origin and in duration (Henson 2016, 89-91). Henson's brief analysis showcases the extreme variety of the content about the Mesolithic period on YouTube. This suggests the need for a wide range of identifiers in order to analyse archaeological content on the platform.

4 Types of (Archaeological) Film

The extensive diversity of archaeological videos is also suggested by Morgan (2014) in her article about archaeological filmmaking. Morgan identifies four distinct genres of archaeological film, which are: expository, direct testimonial, impressionistic, and phenomenological. Each of these genres showcases the archaeological discipline or archaeological fieldwork in a different manner. Expository videos are a documentary style of videos about an archaeological subject and are narrated by professional archaeologists (Morgan 2014, 329-330). Direct testimonial videos are filmed during or after archaeological fieldwork and provide the viewer with a summary of important finds and events that took place during the excavation (Morgan 2014, 331). Impressionistic videos are more of an artistic impression of archaeology and allow for creativity and aesthetics to take a central role in presenting archaeology (Morgan 2014, 332-333). Finally, phenomenological videos provide the viewer with the sensory experience of archaeology and are filmed through a literal point of view of the archaeologist during fieldwork (Morgan 2014, 333-334). Each of these genres of archaeological film serve a distinct purpose and offer the general public a different interpretation of archaeology. For instance, compared to the other genres, expository videos directly provide the audience with factual information about archaeology or an archaeological site and are thus effective at informing the general public. Phenomenological videos grant the audience a

sense of archaeological fieldwork and can therefore help the viewer understand how archaeologists observe and analyse material remains.

Boy, Bucher and Christ (2020) also propose a four type typology of scientific films. Their research analysed a total of 400 German science videos which presented four distinct types of audio-visual science communication on YouTube. The 400 German science videos were analysed and categorized based on a number of coding criteria which included general information such as the title of the video and the number of views and subscribers, but also the primary function of the video (informing, demonstrating, entertaining, etc.) and the communicator of information (from expert to layperson) (Boy *et al.* 2020, 119-120). Resulting from the analysis, four video types of science communication were identified which are: presentation films, expert films, animation films and narrative explanatory films. Similar to Morgan's (2014) categorization, these four genres of scientific film represent different styles and approaches to filmmaking each having varying appearances and purposes. Two of these genres, expert film and narrative explanatory film are strongly influenced by traditional examples of science communication on television. The other two genres, presentation film and animation film, are more comparable to newer forms of (non-scientific) filmmaking already present on YouTube. The studies further shows that scientists are the main actors behind traditional forms of scientific filmmaking on YouTube (expert film and narrative explanatory film) whereas non-scientific YouTubers are usually the actors behind presentation films and animation films. This emphasises the importance and influence of traditional forms of science communication on television and how these continue to exists on online social platforms. In addition, the study suggests that the latter two genres are more successful at reaching larger audiences as these videos tend to be shorter in duration. Non-scientific YouTubers are also more likely to interact with their audience in their videos and in the comment sections which greatly appeals to the general YouTube audience (Boy *et al.* 2020, 120).

Interestingly, Morgan (2014) acknowledges that the four genres of archaeological film, described in her paper, do not fully represent the great variety of existing archaeological video content. Archaeological videos can portray unique combinations of the former genres of archaeological film and are not always exactly defined by these. Especially

archaeological videos on the internet split off from the above categorization and form new interpretations or expressions of presenting archaeology. This is because online videos are often shorter in duration and are sometimes created for different purposes compared to the traditional forms of archaeological film (Morgan 2014, 335). Not to mention, the internet has allowed other users to create and upload archaeological videos as well, referring back to the division between UGC and PGC. Thus, both the studies of Morgan (2014) and Boy *et al.* (2020) suggest a continuation of traditional genres of science communication, originated from television, and the adaptation of newer genres of science communication influenced by the online environment.

Although Morgan states that her categorization allows for more experimental forms of archaeological film to be identified compared to previous categorizations (Morgan 2014, 335), it becomes clear that categorizing archaeological content is never definite and will always remain subjective to its variability. Besides the two sets of typologies presented by Morgan (2014) and Boy *et al.* (2020), descriptive science communication studies often still rely heavily on a number of coding criteria, such as the number of views and subscribers and the type of content of a video, when identifying and analysing scientific videos. Archaeological content on YouTube will likely not present itself as an exception and thus should instead be categorized on its own. A broad spectrum of coding criteria is therefore advised. Nonetheless, the different types of archaeological content on YouTube can still reflect traditional forms of archaeological film or create unique combinations and adaptations of new and traditional genres or typologies presented by Morgan (2014) and Boy *et a*l. (2020). Consequently, these typologies will still prove useful when interpreting archaeological content on YouTube however they should not be regarded as fully representative of the archaeological content on YouTube, as this type of content may vary significantly from the previous fields of research.

Popularity Factors

Welbourne and Grant (2016) analysed the factors that influence the popularity of science communication on YouTube by conducting a content analysis of 390 videos from 39 YouTube channels. In this study, popularity was primarily defined by the number of views

and subscribers on YouTube. One of the main content factors that was used for the analysis was the distinction between professionally- and user-generated channels. Professionally-generated channels are referred to as equipped with the financial resources to produce more content consistently with a higher production value compared to user-generated channels. In theory, this could pose a serious threat to the success of user-generated channels. However, Welbourne and Grant also highlight the value of the participatory role within the YouTube community that is associated more often with user-generated channels. The article proposes that the key to YouTube popularity might not necessarily be the quantity or quality of content a channel can upload but the level of user engagement a channel can generate, which in this regard would highly favour user-generated channels (Welbourne & Grant 2016, 708).

Besides the distinction between UGC and PGC, the number of views, subscribers, and videos of each of these channels were documented. Also the video style, the pace at which information is provided and the gender of the presenter of information were implemented into the analysis (Welbourne & Grant 2016, 707).

The results from this study confirm a preference towards user-generated content (UGC). Professionally-generated channels generally do appear to upload more videos on their channels however, user-generated channels are able to reach a larger audience by attracting more views and subscribers per video. UGC generates more user engagement compared to PGC and is therefore more popular on YouTube. In fact, the UGC and PGC factor was the strongest indicator that predicted YouTube popularity. Secondly, the data shows that another factor that contributed to the popularity on YouTube is a consistent communicator of information. Science communication videos that were presented by a regular communicator were significantly more popular than videos without a regular communicator. The gender of the communicator did not have a significant effect on the popularity on YouTube, even supposing that UGC was presented more often by a male communicator. Lastly, the third and major factor concerning YouTube popularity was related to the pace at which information was presented. Both UGC and PGC that presented their information at a faster pace were more popular on YouTube compared to the channels that presented their information at a slower pace. (Welbourne & Grant 2016, 711).

The results from the content analysis of Welbourne and Grant (2016) appear to be in line with the previously mentioned examples of personal science communication, which are Smith's *Ant Lab*, Duckworth's *ArchaeoDuck*, and Caspari's Instagram account. These personal forms of science communication identify as user-generated content on both YouTube and Instagram and have been arguably successful at engaging their audience with a scientific topic. The statistical correlation between UGC and popularity on YouTube, as revealed by Welbourne and Grant (2016), is thus of major importance when considering science communication on YouTube. Traditional forms of (archaeological) science communication, often professionally produced and originated from television, continue to be present on online platforms, as suggested by Bonacchi *et al* (2012), Henson (2016), De Lara *et al.* (2017), and Boy *et al.* (2020). However their representation and impact on archaeological science communication on YouTube, compared to existing user-generated videos and channels that communicate archaeology, remains unclear. Therefore, in order for archaeological science communication to succeed or even progress on YouTube, it is vital to understand all archaeological content on YouTube, as examined in this thesis.

6. Methodology

This thesis aims to investigate the contemporary situation regarding the archaeological representation on YouTube. The goal of this study is to examine the channels on YouTube that produce content related to archaeology and disseminate archaeological information. In order to accomplish this goal, a total of 80 different archaeological channels were selected for analysis.

Finding Archaeological Content

The channels were first encountered in a preliminary examination by a method referred to as 'snowball sampling'. This method was mentioned and also used by Boy *et al.* (2020) in their examination of science videos on YouTube. This method involves the searching for content by using prominent YouTube channels as a starting point of reference. A new YouTube account was created to avoid any biases during data collection. At first, the prominent channels are found by entering key terms into the search bar of YouTube. Key terms for the data collection of this thesis included terms such as: 'archaeology', 'archaeologist', 'excavation', and 'archaeological research'. The channels relevant to the research question were selected from the search results. Secondly, channels are selected from the recommendations created by the initial selection of channels and earlier search results. The algorithm of YouTube continues to recommend content that is related to previously watched content and the user's personal preferences. New archaeological channels were encountered and selected from the videos recommended by YouTube. Each YouTube channel also has a channel tab which sporadically features other related channels. Consequently, channels were also selected from the channel tab of previously selected archaeological channels. The search for new archaeological channels was halted when content relevant to the research question no longer appeared in the search results, recommendations, and channel tabs.

Quantitative and Qualitative approach

The 80 different archaeological channels documented in the data set of this thesis have been coded with a variety of categories to help understand the archaeological content on YouTube and how these channels communicate scientific information about archaeology on the platform. The coding categories provide a quantitative overview (13. Appendix) of the documented archaeological channels which were analysed to examine the different widespread approaches to archaeological science communication on the platform. Each separate coding category is briefly explained below. The channels from the data set were also examined qualitatively by examining noticeable examples and observations of each coding category independently. These examples and observations are mostly documented in the analysis of this thesis.

Subscribers

One of the primary indicators of the size of a YouTube channel's audience is the subscriber count. The number of subscribers refers to the number of users that receive the uploaded content of a channel in their subscription feed, considerably contributing to the dissemination of the content of a channel. The number of subscribers a YouTube channel has can change significantly over time and differs per channel. The number of subscribers (and other categories) of the archaeological channels were documented in October and November of 2021.

UGC - PGC

This category is divided into two different types of channel: UGC channels and PGC channels. UGC channels are additionally categorized under Individual UGC channels and Organizational UGC channels. PGC stands for Professionally-Generated Content and refers in this thesis to videos on YouTube produced by professional film and television producers, editors and directors (note: not necessarily by professionals in the field of archaeology). An example of a PGC channel from the data set is *Time Team Classics*. This channel uploads full episodes from the popular TV series 'Time Team' that aired on the

British television from 1994 to 2014. As of 2022, it started uploading full episodes on YouTube. Time Team is created by television producer Tim Taylor and presented by well-known actor Tony Robinson. The content itself is therefore professionally produced.

UGC stands for User-Generated Content and refers in this thesis to videos on YouTube produced by users on the internet who do not have the expertise or resources to produce professionally generated video content. Individual UGC channels refer to content produced by individual YouTubers whereas Organisational UGC channels refer to content produced by academic or governmental institutions and organisations.

The difference between UGC and PGC is therefore often defined by the production value and costs of the videos uploaded on a channel. UGC channels (especially Individual UGC channels) generally lack the resources to consistently upload expensive videos with high production values compared to PGC channels that have access to large quantities of professionally produced content or are able to generate professionally produced content themselves.

Content Type

Previous studies on audio-visual science communication offer a wide variety of categorizations regarding the type of content of scientific videos and channels. Therefore, a broad interpretation of content type is employed to categorize the different archaeological channels on YouTube. A total of 11 different content types of archaeological video were identified. Each channel was categorized based on the type of content it was predominantly uploading. The different content types are: documentary, educational, interview, lifestyle, online lecture, podcast, promotional, shorts, top list, tutorial, and vlog.

Documentary

In this thesis, archaeological documentaries on YouTube are defined on the basis of video duration and production costs. The archaeological documentaries on the platform are long in duration, usually ranging between 30 minutes to 150 minutes, and are able to convey great amounts of (in-depth) information about a specific archaeological topic.

Archaeological documentaries on YouTube follow a narrative structure in which the archaeological topic is elaborated upon. Archaeological documentaries are produced by both UGC and PGC channels however the speed at which documentaries are uploaded is strongly depended on this category. Especially individual UGC channels require more time to upload an archaeological documentary on YouTube due to the higher production costs of documentaries (such as the amount of effort and time required to produce documentary type videos).

Educational

The educational type videos are the most generic form of archaeological video on YouTube. These videos provide the viewer with information about a specific (archaeological) topic through narration and are often visually supported by images related to the topic. The narrator is not visible in the video. Compared to archaeological documentaries, educational videos are usually shorter in duration, ranging between 5 to 30 minutes. Educational videos are straightforward and informative in style whereas documentary type videos take more of a cinematic and narrative approach to a topic.

Interview

This content type is characteristic of videos that interview archaeologists or members of the general public in front of a camera. In these videos, the respondents are asked for a reaction or about their opinion or expertise regarding a specific archaeological topic. Since the respondent is asked directly, these type of videos often allow the viewer to be informed and engage with archaeology on a personal level.

Lifestyle

The lifestyle content type covers a wide variety of videos that feature (outdoor) activities related to archaeology, such as site and museum visits, experimental archaeology, and archaeological work performed in the field or in a laboratory. Lifestyle videos are filmed at the spot and invite the viewer to spectate the activity from the perspective of the archaeologist or YouTuber, as if the viewer is right there.

Online Lecture

This content type represents the channels that primarily upload (live) recordings of video lectures. The online video lecture format is very similar to its offline counterpart, apart

from the fact that online video lectures are generally more accessible for the public. Video lectures on YouTube are often recorded in online applications and show the webcam of the presenter giving the lecture. Sometimes, the webcams of other participants are visible as well, which allow for interaction between the lecturer and the present participants.

Podcast

Podcasts are digital recordings of conversations and discussions that have a strong emphasis on the audio aspect, as opposed to the usual audio-visual format of videos. On YouTube, archaeological podcasts are often visually supported by webcams of the speakers and images of the discussed archaeological sites and objects for further context.

Promotional

This content type refers to channels on YouTube that actively promote or advertise an archaeological institution or organization that is not primarily on YouTube. These videos are aimed to redirect viewers to the main website or platform of the archaeological institution or organization.

Shorts

YouTube shorts is a relatively new feature on YouTube which, as the name already implies, refers to very short videos on the platform. YouTube shorts strongly resembles the video format applied by TikTok, another extremely popular video sharing platform. Archaeological shorts provide the viewer with a brief overview of an archaeological topic or usually showcase a singular (archaeological) find of interest.

Top List

This content type is characterized by the listing of archaeological sites and discoveries in video format. Oftentimes, top list videos aim to excite their audiences with extraordinary things related to archaeology which is why top list videos frequently misrepresent the archaeological discipline. Each top list video usually has a specific topic it focuses on. For instance, top list videos rank the most dangerous or mysterious archaeological sites, recent archaeological discoveries, or unexplained phenomena in the archaeological record.

Tutorial

The Tutorial content type refers to videos that step by step explain how to reproduce a specific (archaeological) activity. Tutorial videos primarily provide instructions to the viewer and showcase how the (archaeological) activity is done.

Vlog

The vlog content type is primarily centred around the YouTuber of an archaeological channel. In vlog type videos, the camera is focused directly on the YouTuber(s) which establishes a personal connection between the channel and the viewer. Archaeological information is presented by an individual or multiple individuals who have experience or knowledge in the archaeological field and are thus able to personally communicate this information to their viewers.

Purpose

The purpose category indicates the primary purpose of the communicated information from a channel in relation to the viewer. This category is based on one of the coding categories used by De Lara *et al.* (2017) in their classification of scientific videos on the internet. This thesis established a total of six different channel purposes: educate, entertain, excite, inform, infotain and promote.

Educate

This channel's primary purpose is to teach the viewer about archaeology by providing the viewer with in-depth archaeological information and sometimes by testing the viewers knowledge on the topic.

Entertain

This channel's primary purpose is to provide the viewer with entertaining videos related to archaeology that communicate little to no archaeological information.

Excite

This channel's primary purpose is to excite the viewer about archaeology by showcasing the most fascinating and intriguing aspects of archaeology.

Inform

This channel's primary purpose is to provide the viewer with archaeological information on a basic level. It differentiates from the Educate purpose by not having an educational purpose.

Infotain

This channel's primary purpose is to provide the viewer with archaeological information in an entertaining manner. Humour and information are both important aspects of infotain videos.

Promote

This channel's primary purpose is to advertise or spread awareness of an archaeological activity, organization or institution.

Interaction (low – medium – high)

Also the level of interaction between viewer and scientific channel is a coding category derived from the classification of De Lara *et al.* (2017). Their classification referred to the video components that encourage viewer interaction. In this thesis, interaction refers to three levels of interaction ('low', 'medium' and 'high') between the archaeological channel and the viewer and aims to understand how archaeological channels further communicate or even participate with their viewers. Low interaction means there is minimal or no communication at all between the channel and the viewer. Medium interaction refers to channels rarely interacting with their audience through any means. A high level of interaction means the occasional interaction between a channel and their viewers, for instance by frequently responding to comments. Lastly, full participation refers to interaction that results in the cooperative creation of (scientific) archaeological content on a channel.

Audience (enthusiast – amateur – expert)

The main target audience of archaeological channels are categorized as enthusiast, amateur and expert. The three audience categories reflect the viewer's average

understanding of archaeology and are based on the level of archaeological information presented in the video. An enthusiast audience represents the viewers who share an interest in archaeology but have no further educational or academic background in archaeology. Amateur audiences have a greater understanding of archaeological practices however are not educated in archaeology. Expert audiences represent viewers officially educated in archaeology.

Producer (novice – amateur – expert)

The categorization of channel producers is similar to the categorization of the target audience of a channel and reflects the producers average archaeological understanding and their archaeological education. The channel producer was coded with three categories which are: novice, amateur, and expert. Novice producers have not been educated in archaeology and have essentially no archaeological understanding. Expert producers are (scientific) members of the archaeological discipline and include professional archaeologists, contemporary students and/or professors. Amateur producers fall in between and often have no clear archaeological degree or standing in the academic field. However, amateur producers do present reliable archaeological information and scientific approaches to archaeology on their channels.

Reliability (low – medium – high)

The reliability category of the analysis reflects the accuracy and reliability of the communicated archaeological information. The accuracy and reliability of said information is determined by a variety of factors including whether information is clearly sourced or otherwise referenced, how the archaeological discipline is represented by a channel, the overall factual accuracy of information, the expertise of the channel producer, and the topics discussed on a channel. The categorization ranges from ‘low’ to ‘medium’ to ‘high’ reliability.

7. Results

A complete overview of all the archaeological channels and results are documented in an extensive table that can be found in the Appendix of this thesis (13. Appendix). This chapter will continue to examine the different results from each coding category.

Subscribers

The subscription count of the archaeological channels from the sample vary significantly from one another and are distributed across a wide range of subscriber counts. The channel with the lowest subscription count has 16 subscribers (channel: *Anna Wiman*) and the channel with the highest subscriber count has 3.420.000 subscribers (channel: *Origins Explained*). The top and bottom ten archaeological channels based on subscriber count are displayed in Tables 1 and 2. Both Table 1 and Table 2 display channels which feature a diverse range of types of content, including: Documentary, Top List, Lifestyle and Educational. The videos from the channels from Table 1 are produced by all types of producers whereas the videos from the channels from Table 2 are almost all produced by experts in the field of archaeology.

Note that seven channels were not considered for analysis of this category as their subscription count was set to private. These channels are:

- *Absolute History*, *DTTV – Archaeology*
- *Inforado*
- *Matrix Wisdom,*
- *Blast World Mysteries*
- *CambridgeUniversityCaboVerdeArchaeology*
- *Lightning Top*.

The subscriber count of the remaining 73 channels are represented in a Boxplot, shown in Figure 3. Q1 is located at 1.260 subscribers, Q2 at 20.600 subscribers, and Q3 at 141.000 subscribers. The mean average equals to 206.268 subscribers and ends up being positioned far above the Interquartile Range (IQR) and the median which are pushed towards the bottom of the figure. This means that the distribution of the subscriber count within the sample is asymmetrical and positively skewed, indicating that a majority of the

channels from the sample have a low number of subscribers compared to a small number of significantly larger channels.

In order to keep the data readable and clear, Figure 3 does not show the outliers from the sample. The outliers from the sample are displayed in Figure 4 and clearly show the wide and asymmetrical distribution of the subscriber counts in the data set.

Channel Name	Subscriber Count	Content Type	Producer
Origins Explained	3.420.000	Top list	novice
Timeline - World History Documentaries	3.240.000	Documentary	novice
Skallagrim	1.480.000	vlog	amateur
TREY the explainer	753000	Educational	amateur
History Time	710000	Documentary	amateur
Amazing Stock	641000	Top list	novice
The British Museum	515000	Educational	expert
Crunch	423000	Top list	novice
Ancient Architects	415000	Educational	amateur
Brien Foerster	353000	Lifestyle	novice

Table 1: the top 10 archaeological channels based on subscriber count

Channel Name	Subscriber Count	Content Type	Producer
Cotswold Archaeology	319	Lifestyle	expert
Talmadge Gerald	254	Lifestyle	expert
ArchaeologyLeiden	240	Lifestyle	expert
Antiquity Journal	101	Interview	expert
Society of Black Archaeologists	73	Vlog	expert
Archaeologists Connected	67	Vlog	expert
Archaeological Review from Cambridge	35	Online Lecture	expert
The Armchair Archaeologist	35	Educational	expert
Armchair Archaeology	22	Educational	expert
Anna Wiman	16	Interview	amateur

Table 2: the bottom 10 archaeological channels based on subscriber count

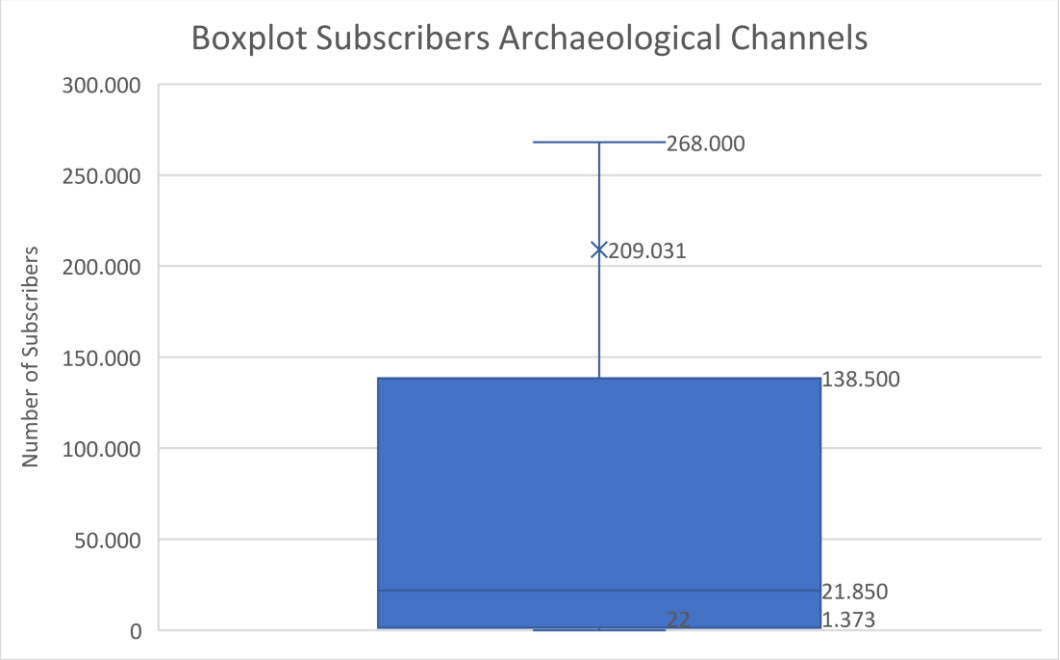
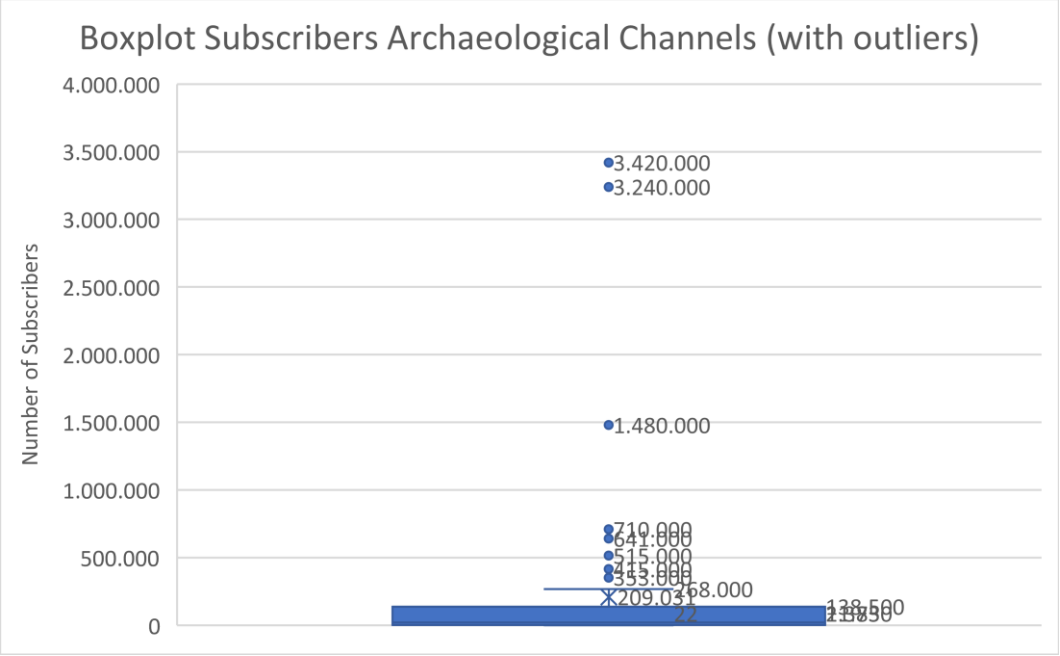


Figure 3

Figure 4



UGC - PGC

A majority of the archaeological channels from the sample are categorized as User-Generated-Content (UGC), as is shown in Figure 5. A total of 61 channels of the 80 channels are UGC and make up 76% of the data set. When put in perspective with the number of subscribers of each channel however, the Professionally Generated Content (PGC) is represented more strongly (Figure 6). Note that the channels that set their subscription count to private are excluded from Figure 6.

Figures 7 and 8 display the frequency and the number of subscribers of PGC and UGC channels from the sample with the UGC channels divided into the individual and organisation subcategory. Figure 7 shows an exact equilibrium between Individual UGC channels and PGC channels and Organisational UGC channels combined. Figures 6 and 8 display a higher subscriber rate for the latter types of channels although this is primarily attributed to the PGC channels, according to Figure 8. The extremely low subscriber count of Organisational UGC channels is noticeable from Figure 8 and suggests that these type of channels are ineffective at reaching a wide audience, compared to the other channel types in this figure. The lack of relative subscribers could partially be explained by their underrepresentation in the data set, consisting of only 26% of the entire sample compared to the 50% of Individual UGC channels, however the same argument does not seem to apply to PGC channels from the sample.

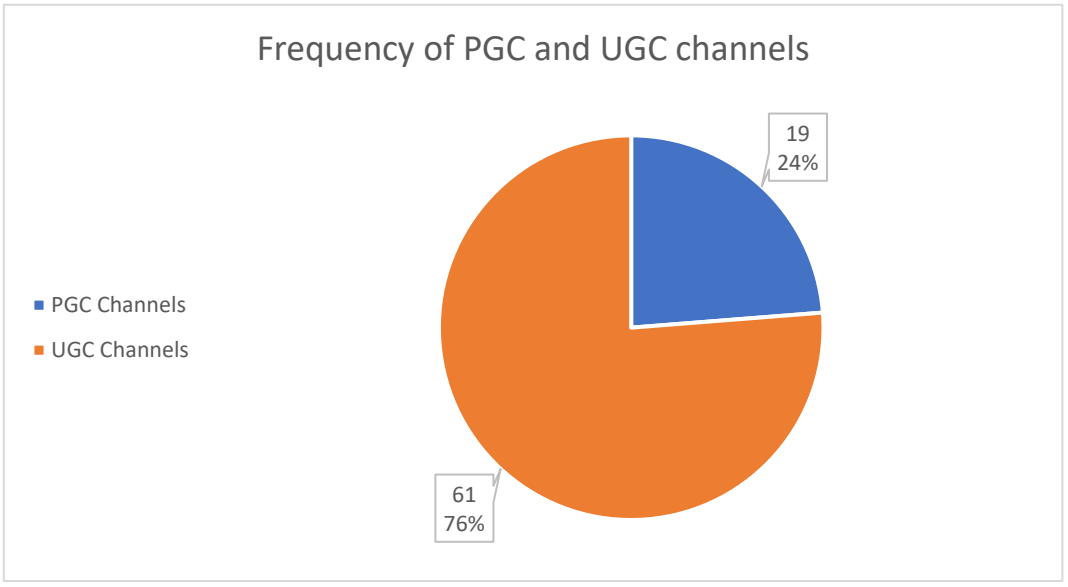
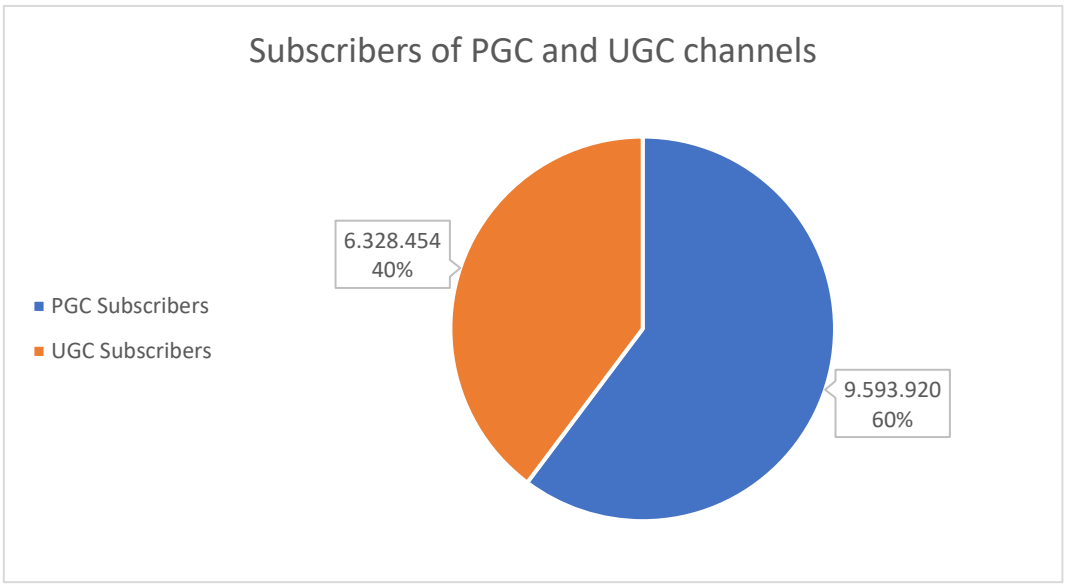


Figure 5

Figure 6



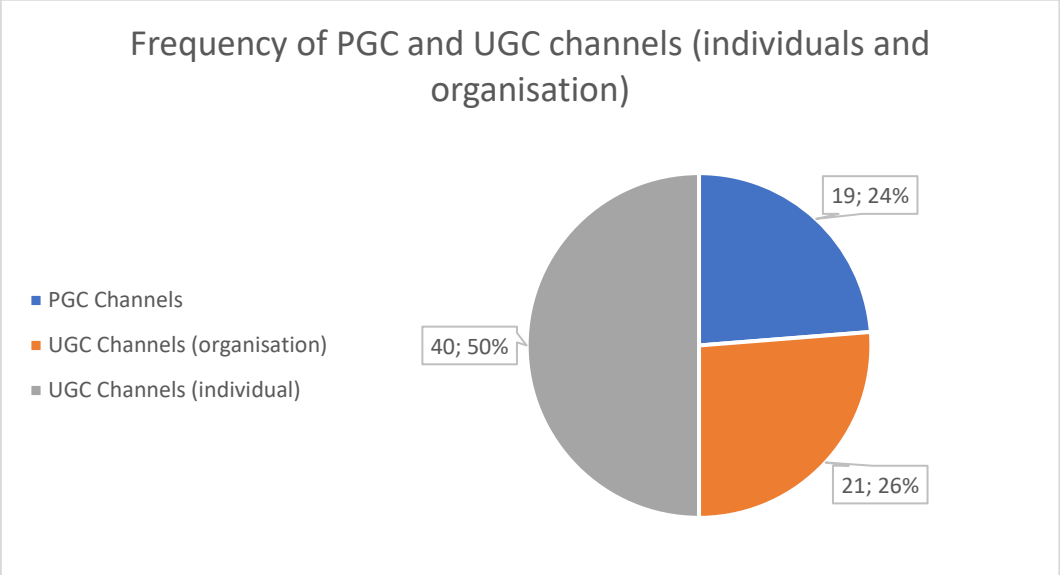
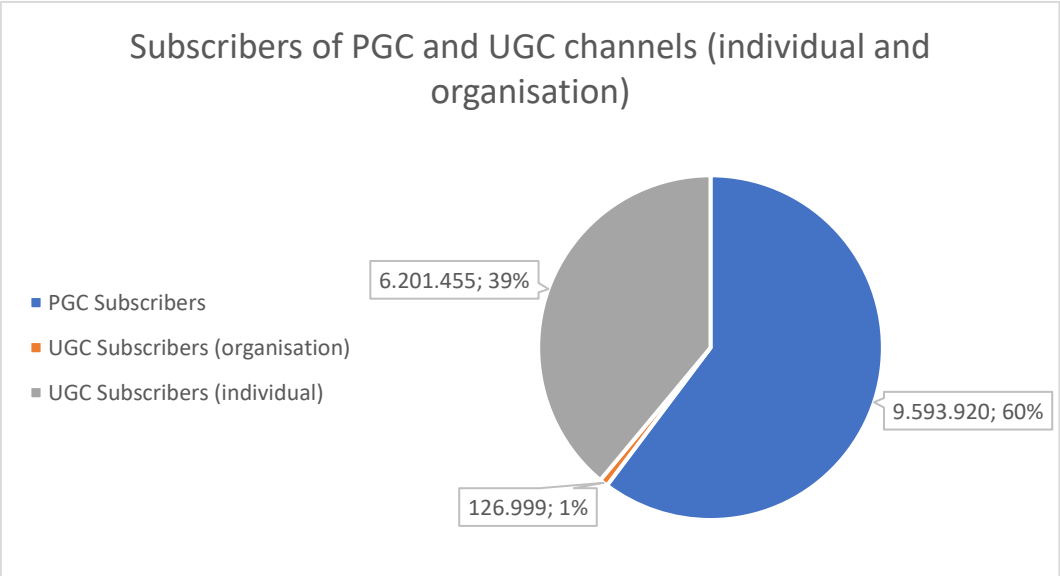


Figure 7

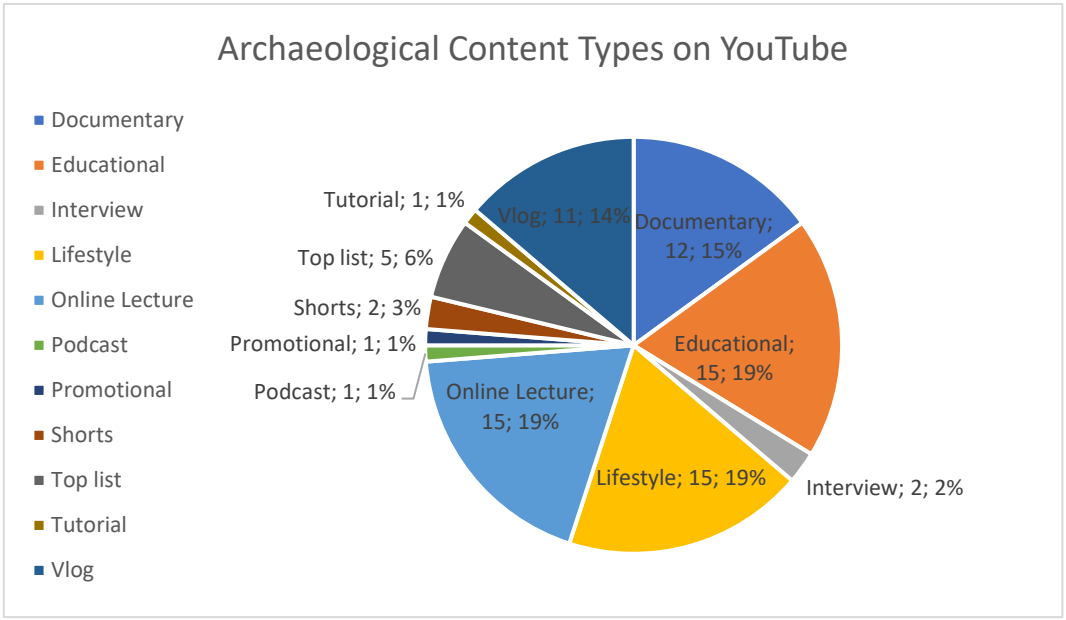
Figure 8



Content Type

The data set features a wide variety of different content types regarding the archaeological content on YouTube (Figure 9). The five most occurring content types were Online Lecture, Lifestyle, Educational, Documentary and Vlog. The former three content types, Online Lecture, Lifestyle, and Educational each separately represent 19% of the channels from the data set. There are 12 Documentary type channels representing 15% of the data set and 11 Vlog type channel representing 14%. The remaining content types are represented significantly less in the data set and are represented by one, two or five channels in total.

Figure 9



Purpose

As is shown in Figure 10 a majority of the archaeological channels on YouTube from the sample aim to provide their audience with information related to archaeology. A total of 44 archaeological channels were identified with Inform as their primary purpose, which equals to 55% of the data set. In addition, the channels with the Infotain and Educate purpose categories generally aim to provide their viewers with archaeological information. As a result, the non-informative categories, which are Excite (10%), Entertain (4%), and Promote (3%), make up a relatively small proportion of the archaeological content on YouTube.

Figure 11 shows each channel purpose aligned with their subscriber count in a boxplot format. The two purpose categories that immediately stand out are Excite and Infotain. The most frequent channel purpose according to Figure 10 is Inform, which is relatively underrepresented in Figure 11, compared to the former two channel purposes. It should be noted however that in Figure 11 the channel purpose Excite is only represented by 6 channels opposed to the 40 channels representing Inform, resulting in an asymmetrical comparison between the two channel purposes.

Figure 12 showcases the four major channel purposes, Entertain, Excite, Inform, and Infotain. The Boxplot of each channel purpose is positively skewed, indicating that a majority of the channels from the sample represent low subscriber counts compared to a minority of channels with relatively high subscriber counts. This is further suggested for the Inform channel purpose by the outliers displayed in Figure 12, which more accurately represent the wide range of subscribers of this channel purpose.

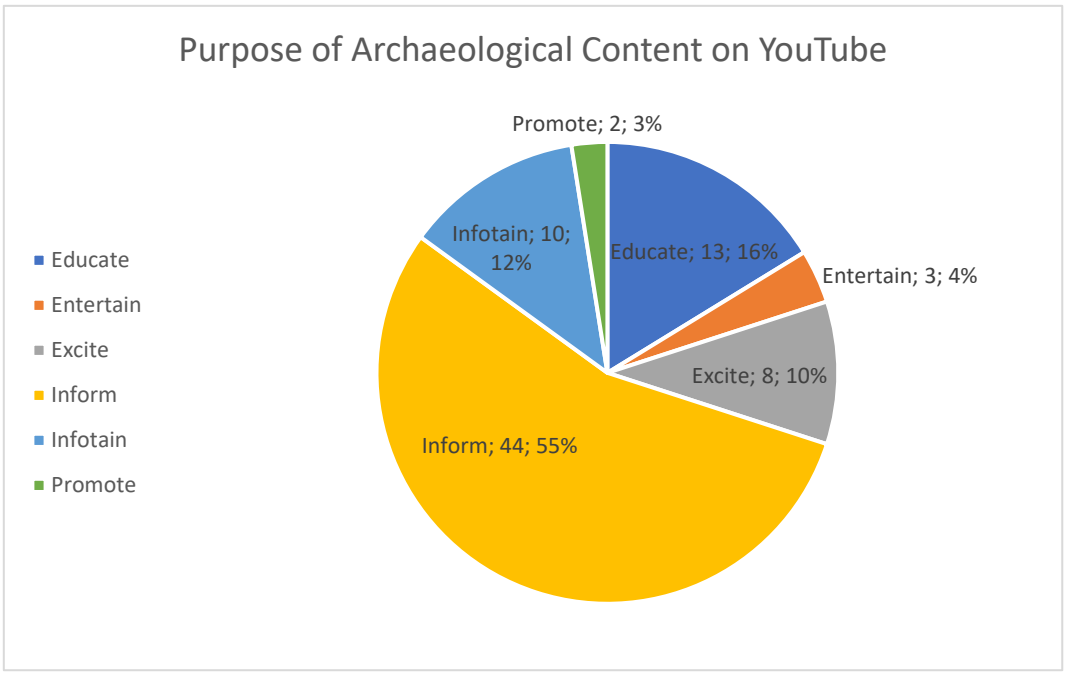

Purpose of Archaeological Content on YouTube
Promote; 2; 3%
Infotain; 10; 12%
Educate; 13; 16%
Entertain; 3; 4%
Excite; 8; 10%
Inform; 44; 55%
Educate
Entertain
Excite
Inform
Infotain
Promote

Figure 10

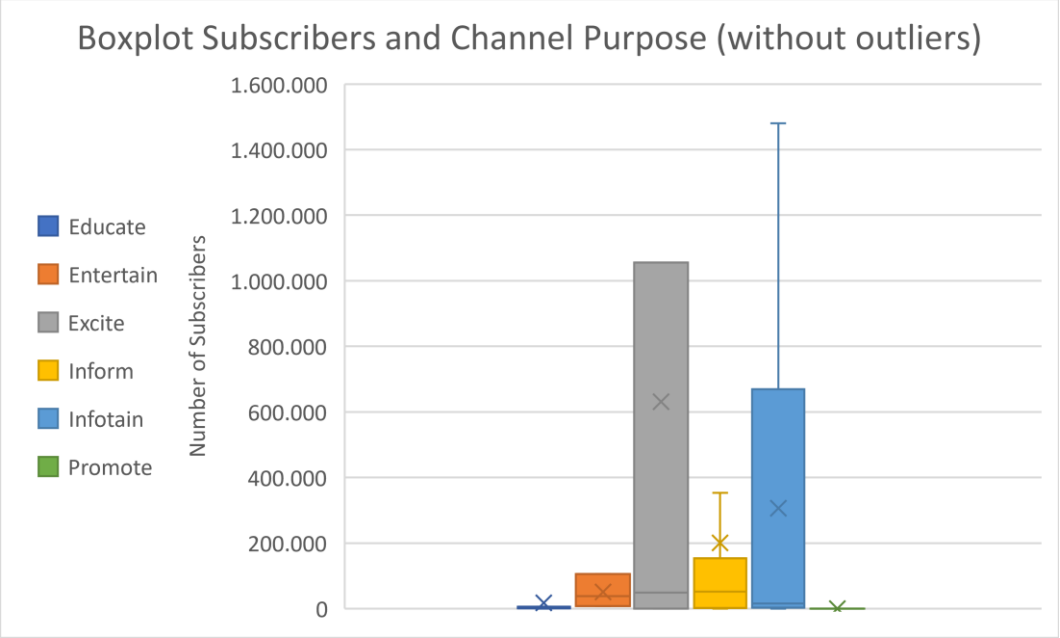
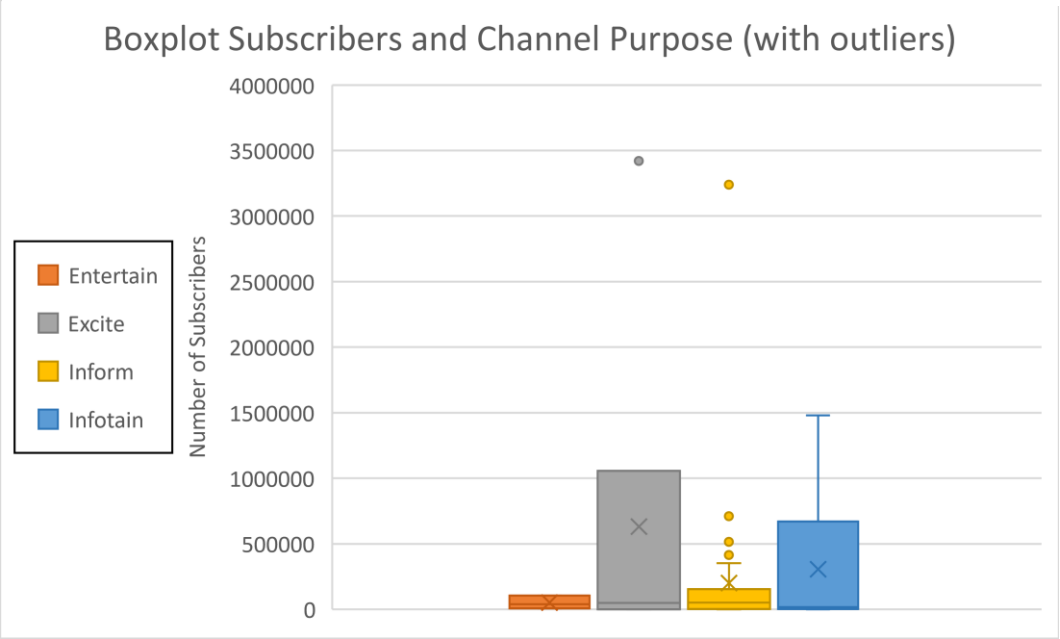


Figure 11

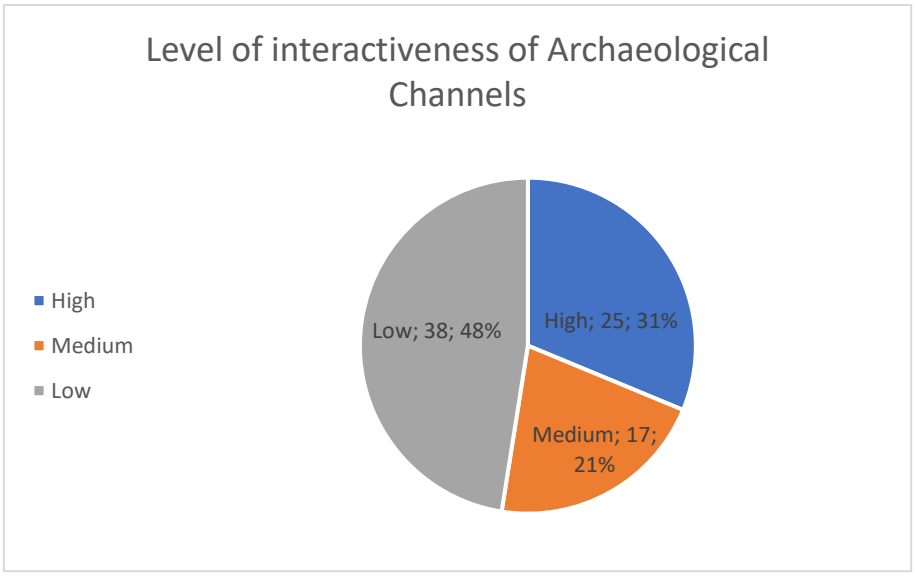
Figure 12



Interaction

The level of interaction between archaeological YouTube channels and their viewers is for most channels from the sample insignificant or even absent. Nearly half of the channels from data set were identified with a Low level of interaction, as shown in Figure 13. A total of 17 channels (21%) from the data set showed limited signs of interaction between channel and audience. The highest form of interaction between viewer and channel was documented to 25 channels (31%) from the data set. No channel from the data set was fully participatory, meaning that despite the channels with higher levels of interaction, the viewer of archaeological content functioned mostly as a receiver of (scientific) information and did not participate in the creation of archaeological content.

Figure 13



Audience and Producer

A majority of the channels from the data set aim to address a non-professional audience, as is shown in Figure 14. This is suggested by the significant number of 42 channels that are aimed towards an Enthusiast audience. Additionally, another 9 channels are aimed towards an audience between the level of Enthusiast and Amateur. Channels that target a more professional audience do appear in the data set but are represented less frequently than channels targeting enthusiast audiences. These channels are represented by 14 channels targeting amateur audiences, only 4 channels targeting fully professional audiences (Figure 14) and 10 channels for amateur-expert audiences.

Over half (52%) of the archaeological channels from the sample have uploaded videos produced by or featuring experts in the field of archaeology (Figure 15). Similar to the results of Channel Purpose and UGC or PGC channels, the relative frequency of the different coding categories is not related to the distribution of subscribers of each coding category. This is shown in Figures 16 and 17 which showcases the boxplot of subscribers for each producer level. Here, the expert producer level is significantly underrepresented compared to results from Figure 15. Note that the subscriber outliers from the expert producer level are still roughly in the same area as the other producer levels.

Finally, novice producer channels almost exclusively produce content for enthusiast audiences (Figure 18) whereas expert producer channels produce content for a wider variety of audiences (Figure 20). Channels with content produced by amateurs are aimed towards enthusiast and amateur audiences (Figure 19).

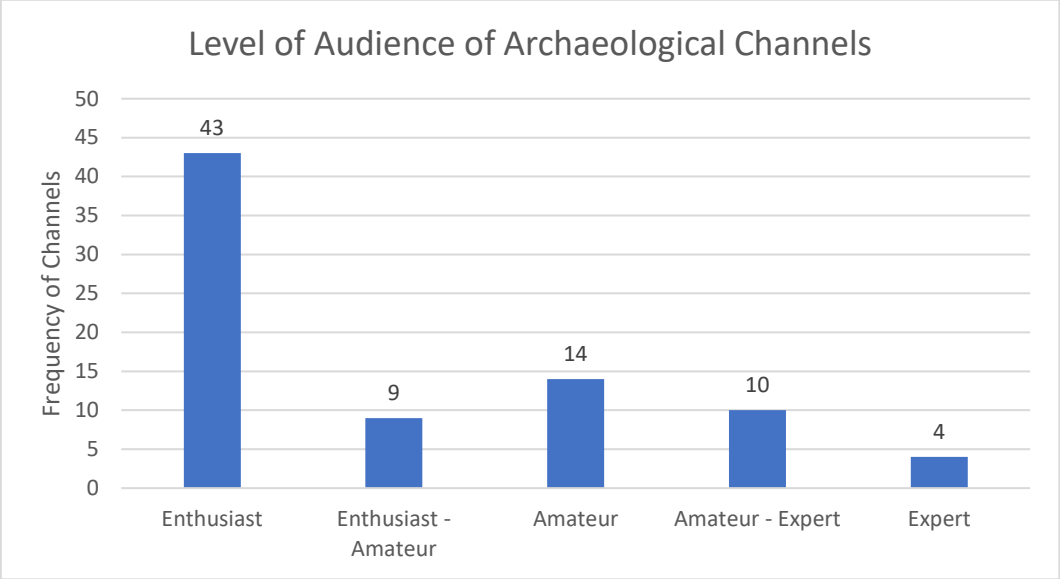
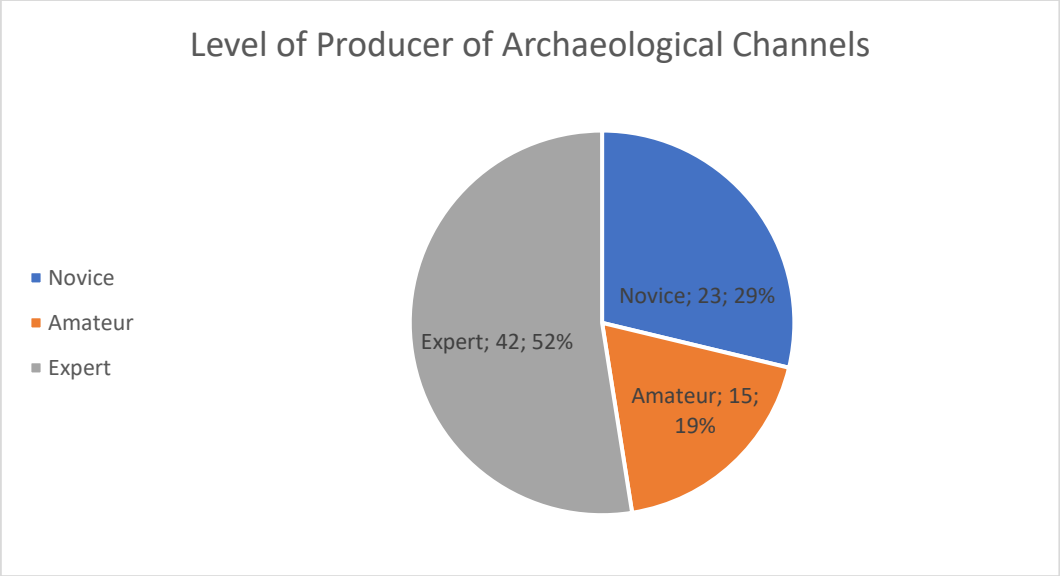


Figure 14

Figure 15



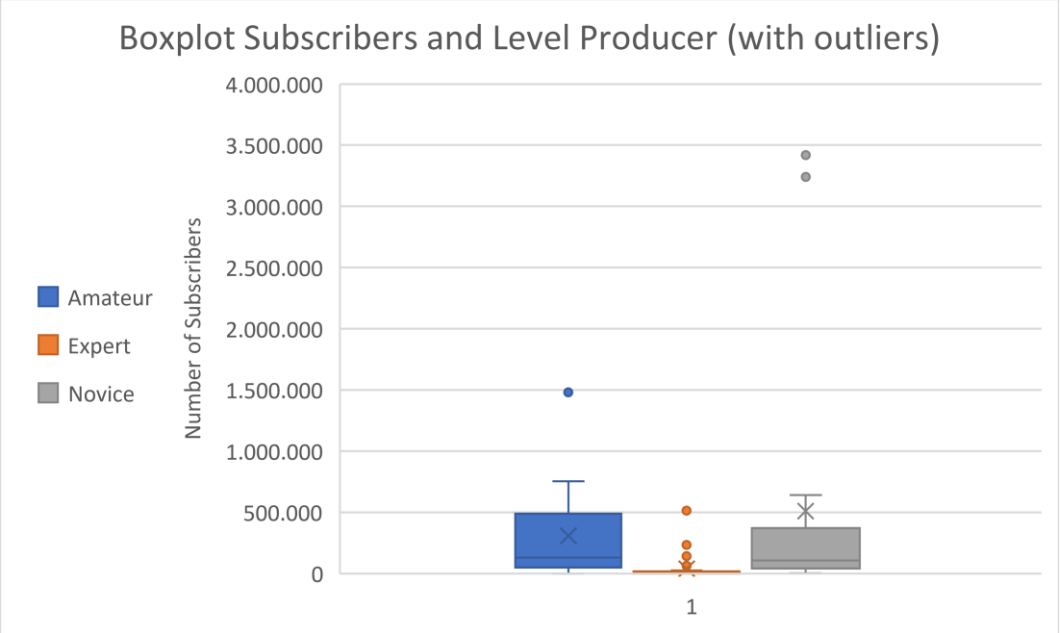
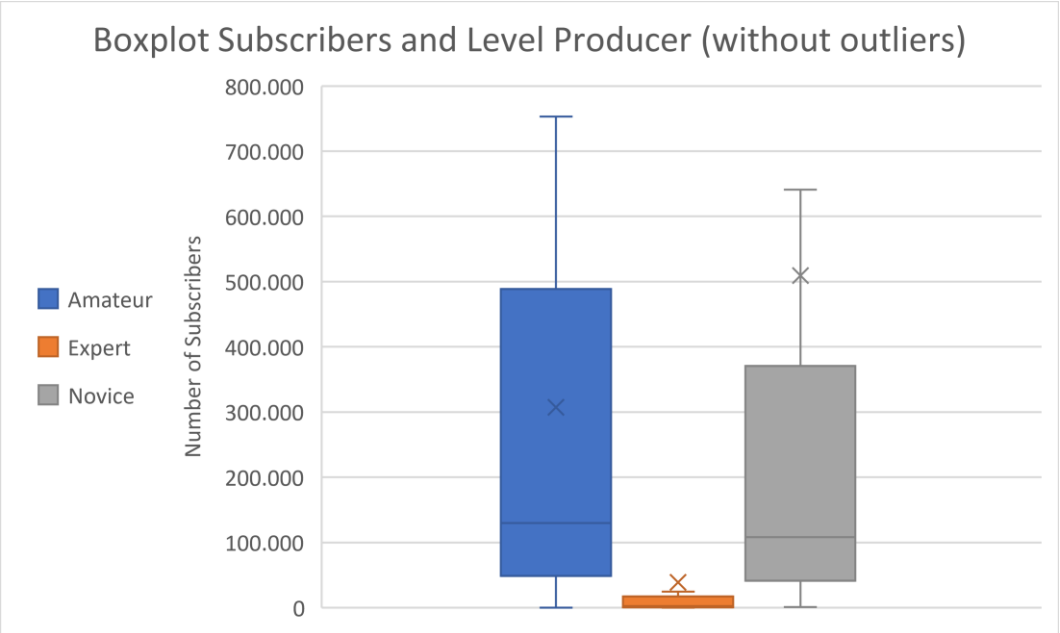


Figure 17

Figure 16



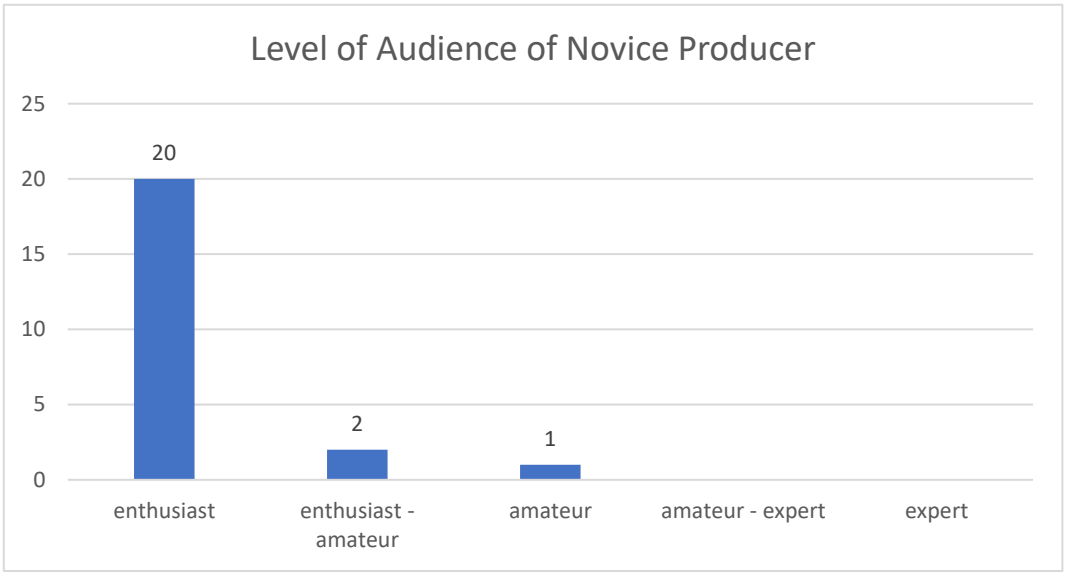
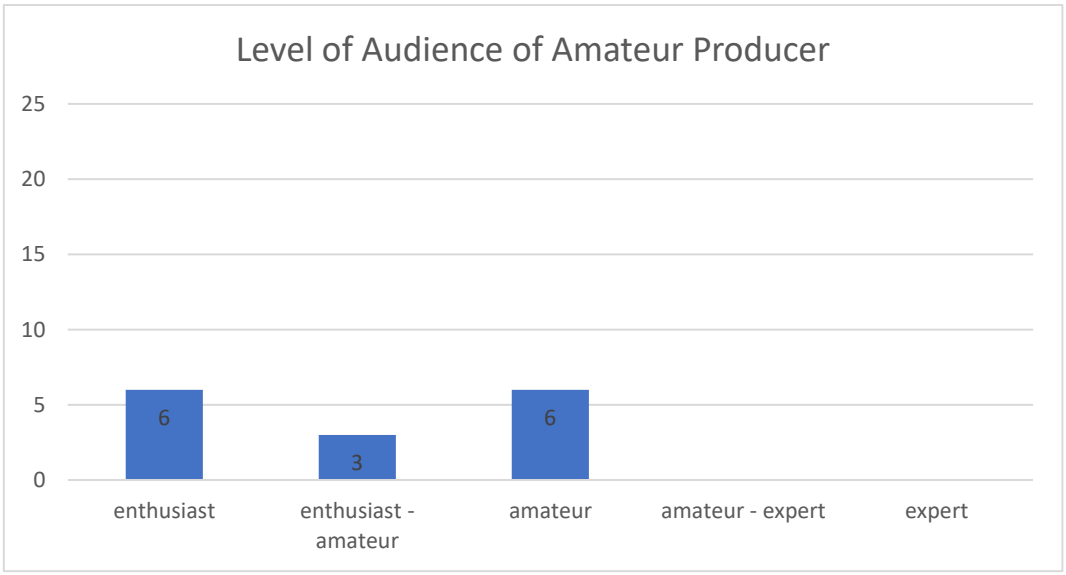


Figure 18

Figure 19



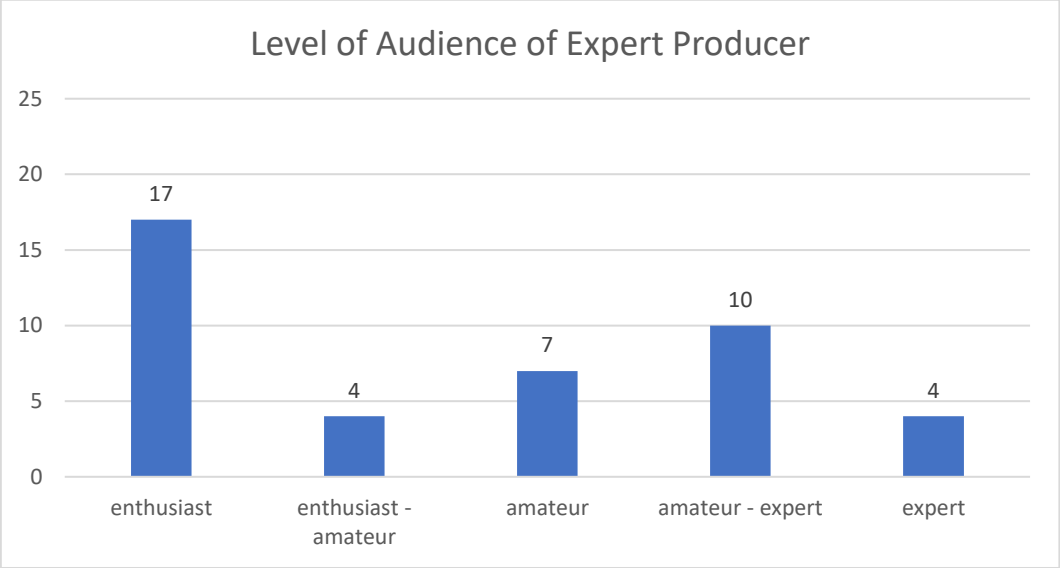

Level of Audience of Expert Producer
25
20
15
10
5
0
17
4
7
10
4
enthusiast
enthusiast - amateur
amateur
amateur - expert
expert

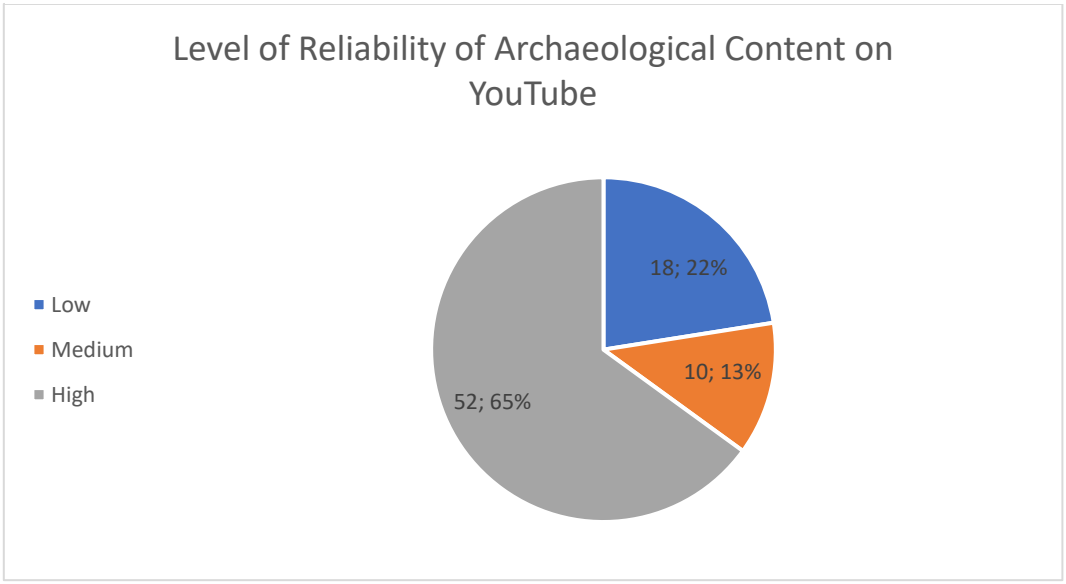
Figure 20

Reliability

A majority of the channels from the data set show a high level of reliability regarding the archaeological information that is presented on the channel and the overall representation of the archaeological discipline. A total of 52 (65%) out of the 80 channels from the sample were identified with a high level of reliability, followed by a low level of reliability (17 channels, 21%), and finally a medium level of reliability (11 channels, 14%) (Figure 21). The greater frequency of high reliability channels should come as no surprise due to the high number of expert produced channels in the sample (Figure 15), as expert produced channels are often associated with higher reliability.

Figures 22 and 23 show the subscriber boxplot of each level of reliability. The channels with a medium level of reliability have on average the most subscribers. High reliability channels are mostly represented by channels with low subscriber counts. Only the outliers of the channels with a high level of reliability appear to be comparable with the subscriber counts of the other levels of reliability.

Figure 21



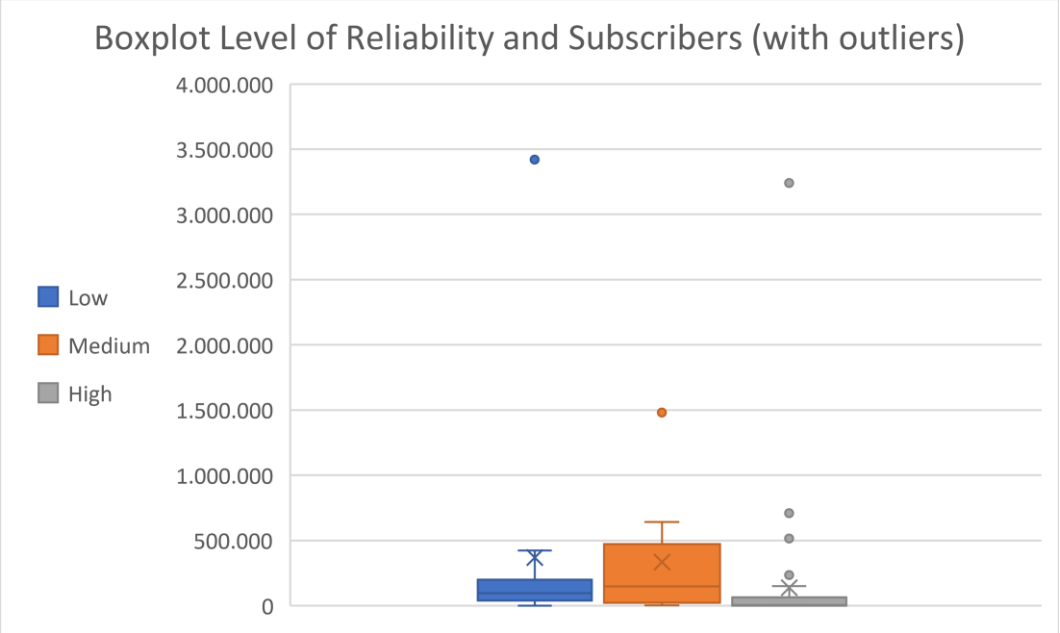
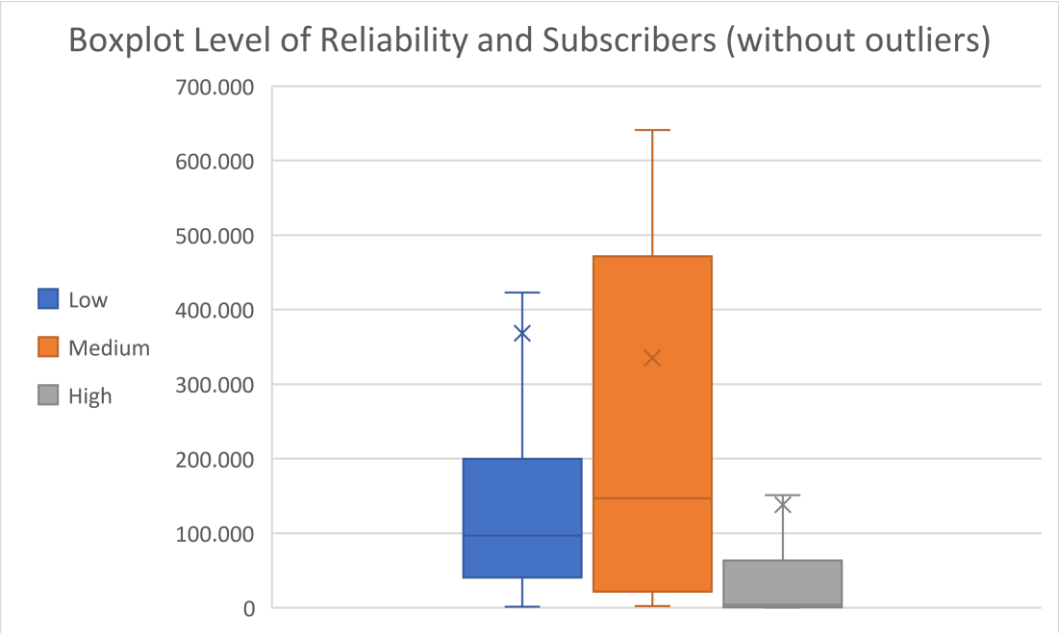


Figure 23

Figure 22



8. Analysis

Subscribers

The top ten channels based on subscriber count (Table 1) make up the 10 outliers of the data set. These channels have a much larger subscriber count compared to the other channels from the sample and cause the asymmetrical distribution within the boxplot. The 10 outlying channels appear to have very little in common which makes it difficult to establish what exactly has made these channels so popular. For instance, the first two channels from Table 1, *Origins Explained* and *Timeline – World History Documentaries*, are by far the largest channels from the sample. *Origins Explained* is primarily a Top list channel that is consistently uploading videos on YouTube. The channel is officially verified by YouTube. The channel is hosted and narrated by an individual named Katrina, however due to the considerable upload speed and channel activity it is unlikely that the content is also solely produced by one individual. The videos of *Origins Explained* mainly consist of images and short animations that showcase or explain the narrated information presented in the video. Based on its video titles, thumbnails, channel overlay and its video content, this channel uses attention grabbing methods to attract an audience. As a result, the content is focused around the supposed most mysterious, spectacular or exciting aspects of archaeology and the past in general. The actual information presented in the videos however fails to provide the viewer with any substantial scientific archaeological information about these topics. Instead, the information often provides a basic overview of a specific archaeological site or object that is listed to be of incredible (archaeological) value. The information of *Origins Explained* is never sourced and often does not consider any archaeological context or expertise. As a result, the information of *Origins Explained* occasionally includes unorthodox archaeological claims, is unreliable, and represents a poor example of archaeological science communication. The second channel, *Timeline – World History Documentaries* is part of the HistoryHit network and has therefore access to numerous professionally made historical and archaeological documentaries. Considering the quality and quantity of the content, the channel uploads very fast, namely two documentaries a week. As opposed to the former channel, *Timeline – World History Documentaries* is able to provide the viewer with in-depth historical and archaeological information often presented by professionals in the field. The numerous historians and

archaeologists that appear in the videos of *Timeline – World History Documentaries* are able to convey and translate scientific information from the academic field to the general public through the documentary style videos. The information is therefore more in line with the academic perspective on a certain topic and is able to communicate this perspective to the general public in contrast to the information of *Origins Explained*.

The other channels from Table 1 also display extremely diversified types of content, forms of interaction, reliability of information, and content provided by different producers and communicators. *Skallagrim, TREY the explainer,* and *History Time* are for instance great examples of channels that upload User Generated Content in contrast to the channels mentioned above. However, *Skallagrim* presents his content about historical weapons and armour in front of the camera and often addresses his audience directly in short but informal videos. The content from *TREY the explainer* mainly consists of long educational videos about archaeology, biology, and palaeontology. *History Time* uploads extensive documentary type videos about both historical and archaeological topics.

Also the channels from Table 2, the bottom ten archaeological channels from the sample, are extremely diverse in content, consisting of channels that primarily upload Lifestyle, Interview, Vlog, Online Lecture, Educational and Interview type videos. Similar to the channels from Table 1, each channel from Table 2 represents a different approach to communicate archaeological information or spread awareness of the archaeological field. For instance, *Cotswold Archaeology* features a variety of videos including full web lectures, short comments by archaeologists and excavation updates. Whereas *The Armchair Archaeologists* features extensive explanatory videos discussing archaeological related topics.

A key difference between the channels from Table 1 and Table 2 is that the content from the Table 2 is mostly produced by archaeologists and archaeological organizations. This does not directly suggest that archaeologists appear to be unsuccessful at communicating science to wider audience however it does show that the content on the smallest archaeological channels based on subscriber count are mostly produced by archaeologists.

UGC - PGC

There is a significant distinction between UGC and PGC channels on YouTube regarding the communication of archaeological science. PGC channels, Organizational UGC channels and Individual UGC channels each have varying access to resources and materials and as a result end up with unique approaches and formats to reach the general public.

An example of a PGC channel from the data set is *Time Team Classics*. The channel uploads separate episodes from the British TV series 'Time Team'. Each episode features a team of archaeologists at work at an archaeological site in the United Kingdom. The programme follows the archaeological team for three days and documents the archaeologists explain how they approach an archaeological site, the important finds they discover, and the conclusions they draw from the fieldwork. The episodes are high budget documentaries originally produced to be aired on the British television and consequently offer stunning shots from the archaeological artifacts and sites, in-depth explanations or analyses of archaeological activities on site or in the laboratory, whilst still remaining accessible and appealing to the average British television consumer. Thus, *Time Team Classics* is able to consistently upload high budget documentaries that accurately communicate archaeological science to the general public.

The pseudo-archaeological channel *DTTV – Archaeology Answers* is also categorized as a PGC channel. This channel uploads extensive documentaries about ancient mythological topics sceptically related to archaeological discoveries. The channel is part of a larger network called DTTV Studios which collaborates with multiple authors and YouTube channels in order to consistently produce and upload pseudo-scientific documentaries on YouTube. *Matrix Wisdom*, another pseudo-archaeological channel from the sample, is also part of this network but is only one of the many channels that are associated with DTTV Studios. Some pseudo-archaeological channels on YouTube appear to be organized to a certain extend and are often collaborating with other (pseudo-archaeological) channels or networks to produce content. This allows for pseudo-archaeological documentaries to be produced and uploaded consistently on YouTube resulting in considerable viewer and subscriber counts, especially when compared to scientific archaeological channels. Naturally, pseudo-archaeological channels present information

that is often not based on scientific research and thus provide a strong contrast to the PGC channels that do communicate archaeological science.

Individual YouTubers that run an archaeological channel also appear in the data set. Channels such as *Dan Davis History* and *Stefan Milo* are relatively popular channels that single-handedly produce and upload archaeological documentaries and educational videos on YouTube. Other examples of individual UGC channels include: *Dig It With Raven, Archaeosoup,* and *Andrew White*. Due to the input from the individual, these channels often reflect the YouTuber's personality and interests which was also an important aspect of Duckworth's channel *Archaeoduck* (Duckworth 2019, 194; see also: 4. Examples of Science Communication on YouTube). A strong reflection of the YouTuber's personality onto the content and the channel is clearly visible on the channel *Dig It With Raven*. Raven (the channel owner) addresses her audience on a personal level in both her videos and in the comment sections and has centred her channel and content around herself. This way, Raven is able to showcase a personal connection between archaeology and her experiences with the discipline and allows her viewers to comfortably approach archaeology and those who practice archaeology. The personal connection that is often established by Individual UGC channels can compensate for the high budget and high quality content produced by PGC channels. Individual UGC channels offer a different approach to communicating archaeological science in which the viewer (the receiver) experiences a closer connection to the communicator compared to PGC channels.

A number of pseudo-archaeological channels from the data also fall under the individual UGC channel category, such as the channel *Andrew Collins.* Similar to the channel *Dig It With Raven* (and most other individual UGC channels), the content of *Andrew Collins* is centred around the channel owner, and reflects his interests and perspective on archaeology.

Organisational UGC channels are represented significantly less in the data set compared to the subscribers of PGC and Individual UGC channels (Figure 8). Organisational UGC channels are interesting in that they usually do not have access to the resources required to produce and upload high budget PGC consistently, and are usually not fully personalized towards one (or more) individual(s). Instead, Organisational UGC channels are represented by archaeological institutions and organisations and tend to upload a

variety of video topics and video types all related to the representing institution or organisation. As a result, Organisational UGC channels provide reliable scientific information presented by archaeological experts and are able to showcase archaeological material and sites accessible to the organisation, think of collection pieces of museums or universities, archaeological sites currently excavated by the organisation, and digital models or data collected by the organisation. Regardless of appearing as great examples for communicating archaeological science to the general public, Organisational UGC channels fail to reach wider audiences suggesting that either their content is not interesting enough to visit or that the content is concealed by the internet and that general public is simply not aware of the content's existence. Examples of Organisational UGC channels are: *ArchaeologyLeiden* (Faculty of Archaeology at Leiden University), *Crow Canyon Archaeological Center* (non-profit organisation Crow Canyon Archaeological Center located in the Mesa Verda National Park), and *Archaeological Review from Cambridge* (voluntary non-profit journal of the University of Cambridge).

Content Type

The numerous channels within each specific content type, although similar in content, vary considerably from one another, for instance in style, target audience or reliability. The content types refer to different approaches of communicating information to the audience by archaeological channels, also employed by scientifically based archaeological channels. To illustrate the variety of archaeological content types that communicate archaeological science on YouTube, this segment will cover distinct examples from each content type individually and explain through example how these content types generally communicate scientific information.

Documentary

An example of a documentary type channel is *Dan Davis Author* which is an Individual UGC channel that uploads archaeological documentaries on his channel. Depending on the duration of the video, the channel produces roughly two videos each month. Most of the documentaries on the channel are about the European Bronze Age although the channel also features documentaries about historical figures (such as Vlad the Impaler and Robin Hood) and the topics related to the Palaeolithic period. The videos are narrated by Dan Davis himself and feature short bits of footage from historical films, images of archaeological finds and documentation, and interactive maps to show the audience the location of the specific topic that is referenced. Dan Davis is a professional author and not a historian or archaeologist, which could impact the overall reliability of his information. However, each of his videos shows extensive research on the topic and lists the (mostly academic) sources used for creating the video.

Another documentary type channel is the previously mentioned *Time Team Classics* which is a PGC channel on YouTube. Because *Time Team Classics* is a PGC channel, it can consistently upload documentaries originally aimed for television. The videos are hosted and narrated by Tony Robinson but primarily focus on the archaeologists working at the site of each episode. The archaeologists are filmed during excavation and are frequently asked to explain what they are doing or what they have found. In addition, *Time Team Classics* uses simple animations to explain and visualize complex narratives or observations in order to help the audience understand the situation as well as the archaeologists' perspective on it.

Archaeological Documentaries on YouTube provide the audience with extensive videos containing in-depth information on archaeological topics. Additionally, documentaries are able to simplify complex archaeological themes through visual explanations, such as digital animations, maps, and models. Oftentimes, archaeological experts push forward the narrative of archaeological documentaries by communicating scientific information relevant to the topic. Archaeological documentaries allow viewers to become fully informed about one specific archaeological topic of their interest whilst retaining the viewer's interest through the narrative of the documentary.

Educational

Trey the Explainer is an individual UGC channel that occasionally uploads extensive educational videos on its channel. It is one of the most viewed channels from the data set according to its subscriber count and considering the number of views on some of its archaeological content, surpassing the two million views mark. At the time of writing, the most recent video 'The Archaeology Iceberg Explained' went viral and has claimed over three million views. *Trey the Explainer* features fully narrated videos which are visually supported by images and simple edits. These include images of archaeological artifacts and sites, fragments from scientific papers, maps, but also include associated pictures from the internet or short (edited) clips from films or documentaries. Each video on the channel covers a topic from a wide range of scientific fields of study such as anthropology, archaeology and biology. Each topic is expanded upon by providing the viewer with information and context surrounding the topic. The content of *Trey the Explainer* is not exclusively informative as the narrator occasionally uses humour to keep its audience entertained throughout the entire video.

Scientific educational channels on YouTube usually provide their audience directly with scientific information through narration. Educational videos include images or clips relevant to the topic that is being discussed. Through this combination of spoken information and visual imagery, educational videos mainly inform the viewer on a topic or showcase a specific argument or viewpoint regarding a topic.

Interview

Bamburgh Research Project is an archaeological channel that uploads videos presenting the work of the archaeological team at Bamburgh Castle, United Kingdom. As part of the

archaeological research project, the team offers field schools to train students in archaeological fieldwork. The channel features videos in which the students present their finds and react on what they have learned during a practical day of the field school. As of recently, the channel has been mostly inactive, having only uploaded two videos in the past five years.

Antiquity Journal is the official YouTube channel of the archaeological academic journal Antiquity. On this channel, authors of the journal are put in the spotlight and interviewed about their publication(s) and research. The concrete purpose of this channel is unclear as it is also used for promoting events, video archiving of scientific animations, and features a demonstration video of experimental archaeology.

Interview type channels provide two different approaches to communicating archaeological science. Interviews with archaeological experts, such as *Antiquity Journal*, directly communicate archaeological information to the viewer through the respondent who is asked to talk about a specific archaeological topic. Other interviews, such as the videos of *Bamburgh Research Project*, provide the viewer with an insight into the archaeological discipline through the experiences and observations mentioned by respondents in interview videos. Besides communicating archaeological science, this content type can also spread awareness of what the archaeological discipline is like and how it is experienced by archaeologists and other individuals.

Lifestyle

JamestownRediscovery is an example of a Lifestyle channel. *JamestownRediscovery* hosts a series called 'Dig Deeper' which showcases parts of the archaeological fieldwork at the Jamestown historical site. In this series, important finds from the site and important activities related to conservation are presented to the viewer by members of the archaeological team. Through the lens of the camera, the viewer is brought to the historic site and is able to familiarize themselves with the site, the archaeologists, and archaeology as a whole.

The format of Lifestyle videos on YouTube is extremely effective at showcasing archaeology to the general public as it allows the viewer to closely examine archaeology without experiencing the usual issues related to public inaccessibility to archaeological

artifacts, sites or laboratories, and the potential needs to travel. Lifestyle videos are often narrated and can therefore be informative, entertaining or a combination of both. Depending on the expertise and reliability of the channel, Lifestyle videos provide the viewer with (scientific) information about the archaeology that is being filmed through live commentary or a voice over that is edited in later.

Online Lecture

Crow Canyon Archaeological Center is a channel from the homonymous non-profit organization located near the Mesa Verde National Park (southwest Colorado). The archaeological centre aims to spread awareness for the archaeology in the region and encourages citizens to participate through citizen science projects. The channel features numerous recordings of webinars given by professional archaeologists and conservationists, each recorded in Zoom. Participants present during the lecture are able to ask questions related to the topic. Based on the presented information and the infrequent use of scientific jargon, the content aims to inform enthusiasts of archaeology about the historic and archaeological aspects of the area.

Dr. Rob's Archaeofilms is a Video Lecture type channel managed by Dr. Robert Stephan from the University of Arizona. The channel features recordings of lecture series that are part of the online bachelor's programme provided by the University of Arizona. The topics presented on the channel mainly include the archaeology and mythology of ancient Egypt, Greece and Rome. Stephan uses audio-visual effects presumably to make his lectures more appealing to his student audience.

Online Lecture type channels can achieve science communication both towards the general public, as is the case with *Crow Canyon Archaeological Center*, as well as towards individuals from within the archaeological discipline, for instance with *Dr. Rob's Archaeofilms*, which is targeted towards students of archaeology. Online Lectures on YouTube communicate scientific archaeological information to their viewers similar to how offline lectures convey information to their live audiences. A speaker, usually an archaeological expert, gives a lecture on a particular (archaeological) topic. Usually, the Online Lectures are recorded with an audience who can ask questions during or after the lecture. Questions can also be asked through the comment section or through the chat if

the Online Lecture is live streamed on YouTube (e.g. *Boundary End Archaeology Research Center*). Note that not only archaeological experts but also Pseudo-archaeologists and other non-professionals make use of this format to communicate information.

Podcast

Archaeosoup is a channel that hosts a wide variety of content all related to archaeology. In addition to the podcast videos, the channel uploads archaeological shorts, vlog type videos and gameplay recordings of archaeological video games. Each week, the channel uploads an episode for the podcast 'Watching Brief', which features Marc from Archaeosoup and Andy Brockman, editor of heritage blog *thePipeLine*, who discuss the latest news and its implications on the fields of archaeology and cultural heritage. Furthermore, *Archaeosoup* has a podcast series named 'Meet the Archaeologists' which features professional archaeologists and discusses interesting aspects of their specialization.

Archaeological podcasts on YouTube can discuss a wide variety of archaeological topics, mention new archaeological discoveries, or highlight the different multidisciplinary views and perspectives that exist within the archaeological field. Similar to the interview content type, the podcast format allows for the speaker (usually an archaeologist or other specialist) to become the central focus of the conversation, which draws attention towards archaeology and consequently results in the dissemination of archaeological information.

Promotional

The Archaeological Channel is the YouTube channel for *www.archaeologychannel.org*, an online platform featuring all sorts of archaeological related media. *The Archaeological Channel* uploads very short videos summarizing and showcasing new content available on the main website of The Archaeology Channel. The videos are used to notify subscribers of the new content and to attract new viewers to the main website.

The promotional content type is also only once represented in the data set, by *The Archaeological Channel*. Their videos do not necessarily communicate scientific information but instead tease or highlight articles from the main website that do communicate scientific information.

Shorts

Archaeologist is a treasure hunting channel that focuses on uploading shorts on YouTube. The channel name and appearance suggest an archaeological nature to this channel's content however the channel showcases a misrepresentation of the archaeological discipline. The content of *Archaeologist* features YouTube shorts showcasing supposed archaeological finds discovered by the use of a metal detector. The process of finding and retrieving objects is filmed from the finder's perspective with the occasional edit and cut to keep the video short and concise. Before the video ends, the object is displayed in front of the camera.

World of Antiquity is another channel that primarily focuses on uploading YouTube shorts. The shorts on this channel consist of quick overviews of archaeological related topics, humorous reactions on inaccurate/pseudo-archaeological claims made on TikTok, and a variety of clips highlighting important moments from other videos on the channel. In his TikTok reaction shorts, *World of Antiquity* uses the same format used by users of TikTok to debunk archaeological inaccuracies disseminated on both TikTok and YouTube.

Shorts on YouTube are great when it comes to briefly present archaeological information or showcase an interesting archaeological find. In contrast to educational videos or documentaries, shorts are significantly shorter to watch and thus more accessible to viewers interested in archaeology without going into extensive detail on the topic. Furthermore, shorts can quickly excite viewers about archaeology or spread awareness of archaeological content on the platform which can result in users visiting archaeological channels.

Top List

Origins Explained is an example of a top list channel. The PGC channel mostly features top list videos with sensational titles that are aimed to attract the attention from users on YouTube. Examples of titles include '10 Most SAD Recent Archaeological Discoveries!', '9 Most Bizarre Recent Archaeological Discoveries!' and '10 Most Mysterious Recent Archaeological Discoveries'. The videos are densely narrated with general but unsourced information, which makes it difficult to fact check for reliability. The videos also feature stock images and clips as well as animations that help explain and visualize the archaeological sites and discoveries listed in the video.

Top list channels are often heavily structured around the exciting and visual aspects of archaeology, as opposed to the scientific and informal aspects. Top list videos showcase images and video clips of extraordinary archaeological sites and discoveries, yet often at the expense of communicating detailed, accurate or reliable information. The format itself is not particularly ineffective or unreliable at communicating scientific archaeological information, however, the archaeological channels from the sample that were identified as Top List channels are mostly associated with communicating unscientific (archaeological) claims and unsourced information.

Tutorial

Janet Stephens is an individual UGC channel is owned by professional hairstylist Janet Stephens. On her channel, Stephens uploads tutorials on how to recreate hairstyles from the past based on archaeological and historical sources. Stephens has successfully combined her profession, passion and interest into a unique approach to archaeological reconstruction and communication. Additionally, Stephens (2008) has published a scholarly article on Ancient Roman Hairdressing in the Journal of Roman Archaeology. Her tutorial videos are separated into two segments. The first segment introduces a specific hairstyle and its historical and archaeological context. The second segment showcases in detail how the proposed hairstyle can be recreated using modern tools and techniques.

Stephens has combined her expertise as a hairstylist with historical and archaeological research to communicate scientific information on her channel. *Janet Stephens* is a unique channel from the data set that showcases an interesting niche within historical and archaeological reconstruction and uses academic sources when communicating scientific information. By showing step by step how to reproduce the historical hairstyles the viewer becomes immersed with the historical and archaeological data and engages with it in an entertaining approach to communicating (archaeological) science.

Vlog

Andrew White is the channel of anthropological archaeologist Andrew White. On his channel, White has uploaded a combination of vlog and lifestyle videos about archaeology and anthropology. In his lifestyle videos, White films during archaeological field schools and shows his audience the various processes that take place during an archaeological excavation. In his vlog videos, White provides his audience with in-depth responses and

analyses on various archaeological topics he finds interesting. In these videos, White records himself behind his desk and talks directly to his audience through the camera. Additionally, White is exceptionally critical towards pseudo-archaeological claims, and often addresses these claims in his videos by dissecting alleged evidence that supports said claims. His critical stance towards pseudo-archaeology has resulted in substantial negative feedback from certain commenters, which White claims, has impacted his personal motivation of producing videos on his channel.

Rachelamun is the channel of a young but experienced archaeologist who aspires to share her personal insight and knowledge on topics related to archaeology and on how it is to be an archaeologist. The content on *Rachelamun* consists of informative videos on specific aspects or issues within archaeology, interviews with other archaeologists, reviews of archaeological related media and answering questions about her experiences as an archaeologist. An example of the latter is a video in which *Rachelamun* discusses the pros and cons of working in the archaeological field. In all of her videos, *Rachelamun* speaks directly into the camera to her audience and uses personal experiences to explain or exemplify certain topics. Again, similar to the content of *Andrew White*, the content of *Rachelamun* is heavily personified from the perspective of the professional archaeologist and aims to reach a wider audience by approaching them more directly, on a personal level.

Vlog type channels differentiate greatly in how they approach their audience and is substantially depended on the type of person hosting the channel. Some archaeological YouTubers provide their viewers with personal insights and experiences regarding archaeology or use humour and entertainment strategies when talking about archaeology, whereas other YouTubers prefer to address their audiences more formally or even professionally. Both approaches result in the communication of scientific (archaeological) information to either the general public or the professional community.

Purpose

Again, the data portrays an asymmetrical distribution of subscribers in relation to the different archaeological channels and subcategories. The subscriber category suggested that the subscriber range is extensively widened by only a handful of outliers from the data set. The same observation is also made for channels considering the channel purpose category. The most frequently occurring channel purpose is Inform however the channels with Excite and Infotain as their primary channel purpose score much higher in the subscriber count.

Based on Khan's research on YouTube user motives (3. YouTube), the most frequently occurring motives predicting YouTube consumption and participation were Relaxing Entertainment, followed by Seeking Information, and Giving Information (Khan 2017, 241). The relevance of entertaining content above informative archaeological content is also suggested by the data, with an exception of content that is exclusively focused on entertainment. Thus, it appears that archaeological content that aims to both inform and entertain its audience is more successful on YouTube and therefore more effective at reaching larger audiences.

Top list channel *Origins Explained* is for instance an extreme example of the Excite purpose category and is the largest channel from the data set, according to subscriber count. The channel provides its audience with exciting archaeological topics and information, despite the lack of overall reliability of this information. As was pointed out before, *Origins Explained* communicates unsourced and non-scientific information to its audience. Instead of communicating reliable information, the channel is focused more intensively on showcasing extraordinary archaeological examples and information that will excite its audience.

Trey the Explainer is an example of a channel with the Infotain purpose. This means the channel combines informative and entertaining aspects to create archaeological content that appeals to a relatively large audience. *Trey the Explainer* uses scientific papers to strengthen or support his points and shows clear signs of thorough background research before making the video. The channel demonstrates that the communication of scientific archaeological information can be very entertaining and appeal to wider audiences.

Another Infotain example from the data set is *Dig It With Raven* which demonstrates the same effect of combining entertainment with scientific information. With a lot of energy and personality, *Dig It With Raven* presents a variety of archaeological topics and communicates scientific archaeological information in a fun and exciting manner. For instance, *Dig It With Raven* has videos discussing archaeological sites, travel advice, book reviews, reacting on historical movies and video games, and even a tutorial for a Cleopatra themed self-care day.

Interaction

Channels identified with a Low level of interaction usually do not communicate with their audience on YouTube through any means. This includes using the Community tab to communicate with their subscribers, responding to comments from viewers in comment sections, or addressing their audience directly in the video. Certain channels, such as *Dr. Rob's Archaeofilms,* have removed the option to leave comments entirely denying any sort of communication between viewers and the channel.

Medium levels of interaction with the audience were characterized by a channel's acknowledgement of their audience, meaning the channel was aware of its audience and was minimally interacting with it apart from providing videos. Such interaction included using the comment section or community tab to disseminate information, reference sources, or recommend additional content to read or watch. Note that information is transferred *to* an audience and not necessarily *with* an audience. In its essence, the Medium level of interaction still represents a one-way form of communication in which a channel provides information to its audience and does little to nothing with the responses or feedback from its audience.

The highest level of interaction refers to channels that occasionally interact with their audiences. These channels use the community tab to send out community polls or to ask questions related to the channel's content. Additionally, these channels interact with their viewers in the comment section by answering questions, reading and liking their comments (this highlights the comment with a heart symbol), and entering discussions started by viewers. Some channels, such as *toldinstone*, even adjust their content or follow up on viewer requests for specific topics. To illustrate, the channel *toldinstone* uses community polls in the community tab that allow viewers to vote on their topic of choice for the next video. Another interactive channel, *Stefan Milo*, shows keen interest in viewer's opinions and responses on most of his educational videos and even highlights accurate information which he did not address in the video.

Thus, archaeological channels can interact with their audience to a great extent by using the various modes of communication available to them on YouTube, however, archaeological channels often fail to address their audiences and show little to no

intention to create interaction between the channel, the viewer and other viewers. Moreover, the level of interaction a channel has with their audience and the modes of communication it uses strongly differentiate between the archaeological channels from the data set.

Audience and Producer

The significant difference in subscriber count between expert producer channels and novice and amateur producer channels is partially explained through the fact that Experts are the only producer type that upload scientific content aimed at professional audiences, as is shown in Figures 18 to 20. Content aimed at professional audiences does simply not appeal to the average YouTube user due to the usage of complex jargon and the archaeological niche in which this content is usually situated. This is further suggested by the data that shows a high frequency of channels that target enthusiast audiences (Figure 14). Unsurprisingly, amateur and novice producers mostly upload content that appeals to the mainstream audiences of YouTube and is aimed towards laypersons and amateurs of archaeology. In contrast, content produced by experts is more diverse considering its target audience, meaning it can be aimed towards enthusiasts, amateur or experts audiences (Figure 20).

However, the target audience of content produced by experts is likely not the only explanation for the relatively low subscriber counts for channels with content produced by experts. The subscriber outliers of channels produced by experts for instance, suggests that content produced by experts can certainly keep up with novice and amateur producers, although this does not seem to apply to a vast majority of expert channels.

An example of a channel that features content produced by experts is *CambridgeUniversityCaboVerdeArchaeology* which is a channel that targets enthusiast audiences. The channel showcases two main issues that are oftentimes associated with channels that feature content produced by experts. These issues hinder the popularity of these channels and therefore their ability to communicate scientific information to wider audiences. The first issue is related to the narrow archaeological niche this channel represents. The name of the channel, *CambridgeUniversityCaboVerdeArchaeology*, already insinuates this narrow niche. The channel has uploaded five Lifestyle type videos about the archaeological excavations and the community project that took place at the UNESCO World Heritage Site of Cidade Velha, Cape Verde. As a result, the channel only offers perspective on this specific archaeological project and is likely of little interest to audiences who are not familiar with this particular site or project. The focus of this channel is therefore too narrow in order to reach wider audiences, even when these

audiences are generally interested in archaeology. Secondly, the channel has ceased its activity after uploading five videos of which the last video in 2016. It appears that after the Cidade Velha project had concluded the channel was abandoned. As a result, the channel has become one of the many niche archaeological channels on YouTube that fail to reach any significant audience due to limited activity. When a channel stops uploading videos and becomes inactive, it quickly disappears from YouTube's recommendations which further decreases its chances to reach the users on YouTube. According to the data (Figures 16 and 17), a majority of the Expert producer channels represent low subscriber counts, which are thus likely correlated to short term channel activity and/or a niche channel focus.

Reliability

High reliability channels are predominantly produced by experts in the field of archaeology. These channels are affiliated with archaeological organizations and academic institutions or are presented by individuals who have a certified expertise in archaeology or the related topic. High reliability channels are also produced by the amateur producer category which in this context refers to channels without a certified archaeological background. Amateur producer channels showcase high levels of in-depth research into the presented topic and often list their sources in the video or in the video description. Overall, archaeological channels from the data set with a high level of reliability are great communicators of scientific information. Therefore, the results showing a majority of highly reliable and accurate archaeological channels is a positive sign for archaeological science communication.

Dan Davis Author is an example of an amateur producer channel that features archaeological information with a high level of reliability. The channel description clearly states that the channel owner and presenter is not a historian or archaeologist. However, to legitimize the archaeological and historical information in his educational videos, Dan Davis lists both video and academic sources in the video description.

The archaeological channels from the data set also include a number of low reliability channels. Although these channels generally fail to source or reference their archaeological information, it must be noted that a substantial amount of their information is in fact accurate and in line with the academic field of archaeology. The issue with low reliability channels is that this information is interwoven with ambiguous and unsupported archaeological claims as well as inaccurate representations of the (scientific) archaeological discipline. This makes it difficult for the viewer to distinguish which information is accurate or scientifically based and which information is not. As a result, low reliability channels establish a pseudo-scientific version of archaeology on YouTube that opposes the archaeology presented by channels that communicate archaeological science. For instance, pseudo-archaeological channels on YouTube emphasise aspects of sensationalism and obscurity to generate views and include topics such as modern technologies in the ancient archaeological record, extraordinary archaeological sites and artifacts, and archaeological evidence for mythological or alien appearances in the past.

Because these topics are often still tied to the archaeological discipline or represented as such, low reliability channels hinder the communication of scientific information by disseminating inaccurate or false archaeological information and by misrepresenting the archaeological discipline.

Low reliability channels are mostly managed by pseudo-archaeologists and treasure hunters. Some of these channels unjustly identify themselves as archaeologists or archaeological channels. This is achieved by referring to archaeology in the channel name or channel description, by decorating the channel with archaeological features (such as: trowels, sand, shovels, and images of archaeological sites), and by discussing archaeological related topics (such as: pyramids, ancient civilizations and megalithic structures). Oftentimes, these channels will refer to 'archaeologists' or 'historians' without a clear reference or source. Other low reliability channels instead distance themselves from professional archaeology and present information and archaeological topics that are said to be avoided or overlooked by archaeologists and historians.

Ancient Astronaut Archive is a channel that uploads educational videos on both archaeological and astronomical topics. The channel provides its audience with updates on new archaeological discoveries and reviews on ancient archaeological sites. *Ancient Astronaut Archive* states in its channel description that it aims to explore topics beyond the scope of current academic understanding. As a result, the presented topics on the channel range from ancient electronic devices to the mysteries of Göbekli Tepe and global conflicts between ancient civilizations. Despite the wide range of unscientific archaeological content and its failure on correctly sourcing or referencing its information, it is in fact officially verified by YouTube, indicating that this channel is recognized by YouTube and does not violate YouTube's official Community Guidelines and Terms of Service. This channel being verified by YouTube suggests YouTube's disregard of non-scientific archaeological channels on its platform and how YouTube acts towards said channels and content.

Adventure Archaeology is a treasure hunting channel that identifies itself as an archaeological channel in its channel name and channel description. *Adventure Archaeology* features lifestyle type videos which showcase the finding and uncovering of historical and archaeological objects in the wild. The practices presented on the channel

differentiate from professional archaeological practices and involve the intense usage of metal detectors and fail to document any archaeological context. Consequently, the audience of this channel is presented with a misleading understanding and interpretation of the archaeological discipline. *Gone Digging* is a similar example from the data set of this type of treasure hunting channel.

Medium reliability channels are as suggested in between high and low levels of reliability. These channels do not necessarily fit in either category and vary greatly regarding the overall reliability of their information. Oftentimes, these channels present adequate archaeological information however often do not include their sources or do not represent archaeological expertise to legitimize their information.

9. Discussion

The results and analysis of the data set show an extremely diverse and complex accumulation of archaeological channels that provide a perspective into the communication of archaeological science on YouTube. One of the first aspects to notice from the data set is the minor niche that archaeological channels occupy within the entire YouTube platform, as was suggested by Bonacchi *et al*. (2013, 60-61; see also: 5. Former Research on the Communication of Science on Social Media Platforms)**.** The subscriber counts of the archaeological channels from the data set are significantly lower compared to the subscribers counts of the currently popular and mainstream channels on YouTube, which include both informative and entertaining channels. Even the two most popular channels from the sample, *Origins Explained* (3.420.000 subscribers) and *Timeline – World History Documentaries* (3.240.000 subscribers) cannot compare to the mainstream channels on YouTube with at least double that number of subscribers.

Additionally, a reoccurring pattern in the results from the data set is the asymmetrical distribution of the subscriber counts of archaeological channels, especially when considering content that is produced by experts and/or features highly reliable archaeological information. This means that on YouTube the communication of scientific information related to archaeology is mostly represented in the data set by small YouTube channels and only a handful of relatively larger channels. The few outliers from the data set are considerably larger than the other archaeological channels (Figures 3 and 4), but do not necessarily communicate scientific information. It suggests that that most of the archaeological channels on YouTube are relatively unrecognized compared to a minor group of archaeological channels that successfully reach larger audiences on the platform.

As was suggested by Khan's (2017) research on YouTube's user motives, the primary motive for consumption and participation on YouTube is to be entertained. Archaeology, as a scientific discipline, can in fact provide its audience with an entertaining aspect, however in its essence is an informative field of study that aims to understand and interpret the archaeological record. Therefore, it is not surprising that most archaeological content on YouTube primarily aims to inform its audience and relatively few archaeological channels focus on entertainment, as is confirmed by the data set

(Figure 10). Still, archaeological channels that implement an element of entertainment appear to be much more effective at reaching an audience on YouTube. Some of the most noticeable archaeological channels analysed in this thesis, such as *Trey the Explainer*, *Janet Stephens*, or *toldinstone*, showcased a great understanding of balancing between providing accurate archaeological information and producing content that is interesting or entertaining to watch, resulting in successful science communication. The key to successful communication on YouTube is therefore not only by uploading videos containing highly reliable archaeological information but also by reflecting and acting on how the audience responses to these videos, which leads to the importance of interaction between channel and viewer.

Due to the wide variety of archaeological channels on YouTube and how these channels interact with their audiences, it is impossible to associate a singular model of science communication with the archaeological content on YouTube. What becomes clear however is that each of the science communication models presented in this thesis (2. Science Communication) are to a certain extent represented on YouTube. The first model, the Deficit Model, is represented by channels that upload archaeological videos on YouTube but do not interact with their viewers through any means on the platform. This type of channel showcases a one way flow of information in which the viewer is regarded as only the recipient of the archaeological information. The second model, the Dialogue Model, is represented by channels that showcase diverse levels of interaction with their audience. This can be achieved by using the Community tab or by responding to individual comments on videos. However, the intensity of interaction and communication between channel and viewer is for archaeological channels on YouTube still severely limited. Oftentimes, viewers have little to no (direct) influence on a channel's content and their feedback is usually addressed with a singular response showing gratitude or intrigue. Nonetheless, users on YouTube have the opportunity to provide feedback to a channel's content and are able to discuss archaeology with the channel and other viewers. Thus, information is moving in two directions. The final model, the Participation Model, is represented by individuals that participate with archaeological science communication by uploading their own archaeological videos on the platform. YouTube offers its users a platform on which they can upload their own content (as long as it aligns with YouTube's

Community Guidelines and Terms of Service), which includes archaeological content. As the data set reveals, archaeology on YouTube is not only represented by experts in the field of archaeology but also by laypersons, amateurs, and students, each contributing to the communication of archaeology on the platform. This approach leads a wide representation of archaeology on YouTube with each channel varying greatly in reliability and accuracy. Consequently, archaeology is represented both accurately and inaccurately on YouTube which impacts YouTube's overall ability to communicate scientific archaeological information. To illustrate, this approach allows pseudo-archaeologists and treasure hunters to present themselves as archaeological channels, when in fact their archaeological information and presentation of the archaeological discipline conflicts with the professional archaeological discipline. Issues related to the democratization of science communication, argued by Durodie (2003; see also: 2. Science Communication), the increasing quantity of uncontrolled information disseminated on social media platforms, argued by Bubela *et al.* (2009, 516-517), and YouTube's inadequate response to the dispersal of misinformation and disinformation on the platform (see also: 3. YouTube) further aggravate the issue of inaccurate representations of archaeology on YouTube as well as the dissemination of unreliable archaeological information, negatively impacting archaeological science communication.

Archaeological content on YouTube and the producers are dispersed and individually organized. Archaeological channels do not only vary in their level of reliability and expertise, as is described above, but also significantly differentiate on who is responsible for the content uploaded on YouTube. Archaeological channels are managed by archaeological organizations and institutions (such as universities, museums and heritage centres), by television networks and media corporations, and by individuals, which include experts, amateurs and laypersons. Furthermore, archaeological content on YouTube offers a wide variety of content types and consists of both UGC and PGC. Noteworthy is that nearly all archaeological channels appear to operate on their own. The exception are some of the pseudo-archaeological channels from the sample that focus on uploading videos of the documentary and educational video type. *DTTV – Archaeology Answers*, *Boaz Mysteries* and *Matrix Wisdom* are examples of channels from the data set that appear to collaborate with each other under the imprint of DTTV Publications, an

independent publisher. The content on these channels is written and produced by authors of DTTV Publications and emerge across the different channels. Additionally, collaborating pseudo-archaeological channels are often featured on the Channel tab of said channels.

Other archaeological channels mostly appear to operate independently, and in the case for individual UGC channels also on their own initiative. PGC channels are often managed by large television networks which have the resources to consistently produce content of a high production value or have access to an extensive data base full of archaeological content. On the contrary, UGC channels are of a much smaller organizational scale or are managed by single individuals and feature content with considerably lower production costs. As a result, PGC channels are more efficient at producing archaeological content in general. According to the data, PGC and UGC archaeological channels are both noticeably present on YouTube. PGC channels are represented less frequently in the data set however do account for the most subscribers, especially compared to organizational UGC channels which account for a minimal number of subscribers (Figures 7 and 8).

Organisational UGC channels often suffer from a variety of issues that result in low subscriber counts and an insignificant impact on archaeology as a whole on YouTube. Certain organisational UGC channels focus on a specific archaeological niche that is unlikely to attract a wide audience, such as *CambridgeUniversityCaboVerdeArchaeology*. Other channels, including *ArchaeologyLeiden* (the YouTube channel of the Faculty of Archaeology in Leiden), showcase the opposite and feature a wide variety of videos for different audiences resulting in a lack of channel focus. The inconsistent uploading of videos and channel inactivity are other frequently reoccurring causes for archaeological channels that result in low subscriber counts and thus unsuccessful attempts at reaching the general public.

Based on the above, UGC should not directly be dismissed however. The relevance of interaction between channel and viewer remains an important aspect on YouTube and (archaeological) science communication. As was suggested by Smith from *Ant Lab* (www.decorrespondent.nl), Duckworth from *ArchaeoDuck* (Duckworth 2019), and Caspari from *@ginocaspari* (Instagram Account; Caspari 2022) the personal connection established by channels managed by individuals have a strong impact on how audiences

interact and engage with the scientific topic. The individual acting as the personal mediator between the viewer and archaeology offers many advantageous aspects for archaeological science communication. This type of content is more directly aimed at the general public by abstaining from complex archaeological jargon, or otherwise by carefully explaining this jargon, and by selecting archaeological topics that will interest the general public, without making the narrative too niche or convoluted. More interaction with the viewer combined with a personal and casual approach to archaeology also allows for greater feedback from the viewer, as demonstrated by Duckworth (2019, 196). Viewers are more likely to ask questions or comment on the topics discussed in the archaeological videos, leading to greater interaction with archaeologists as well as accessibility to archaeology. Additional archaeological channels from the data set that reflect this personal approach to communicating archaeology are *Skallagrim, Stefan Milo, Janet Stephens, Archaeosoup, Dig it with Raven, Andrew White*, and *Rachelamun*.

10. Conclusion

The data set presented in this thesis features a wide diversity of archaeological channels on YouTube that vary immensely in content type, formatting, style, quality, reliability and target audience. Due to the variety of archaeological channels, archaeology on YouTube is highly dispersed and represents many individual attempts to interact with the general public or have them engage with archaeology. Based on the many categories used in this thesis, as well as the categories described in previous studies, digital archaeological content (on YouTube) cannot be described briefly and requires a closer examination to fully understand.

The results from the content analysis of 80 different archaeological channels suggest that archaeology is only a minor niche on the entire platform. Most archaeological channels from the data set have low a subscriber count whereas only a small number of archaeological channels, the outliers of the data set, appear to have gathered a substantial audience compared to most archaeological channels. This same pattern is also apparent for the coding categories Channel Producer and Reliability. Channels produced or managed by archaeological experts and channels coded with a high reliability are usually great communicators of archaeological science, and appear frequently in the data set. Yet, when compared to other archaeological channels, their subscriber counts fall relatively short, with an exception for only the few outliers. This indicates that archaeological science communication is present on YouTube, however only a few of these scientific archaeological channels seem to be able to reach a wider audience.

Both the data set and former research suggest that entertaining aspects are important motives for consuming (archaeological) content on YouTube. Most archaeological channels predominantly aim to inform or educate its audience about archaeology, however archaeological channels that combine informative and entertaining aspects appear to be much more effective at reaching wider audiences on YouTube. Entertaining aspects can make archaeology and archaeological science communication much more interesting for the average user on YouTube and should therefore definitely be considered when attempting to communicate archaeological science on the platform. Optimally, an scientific archaeological channel should want to find the balance between communicating

accurate and reliable archaeological information and producing content that appeals to their viewers.

Archaeological content on YouTube can be divided into three categories: Professionally-Generated Content (PGC), Individual User-Generated Content (UGC), and Organisational User-Generated Content. Each category is represented by a different type of organisation or individual and consequently produces content that varies in production value and costs, reliability and personal interaction with the viewer. Organisational UGC channels, which are mostly represented by archaeological institutions and organisations, surprisingly account for extremely low subscriber counts compared to the other archaeological channels from the data set.

An important aspect of archaeological science communication on YouTube is interaction between the channel and the viewer. Interaction through the comment section of a video or the community tab of a channel allows the viewer to engage with the archaeological content and ask questions about archaeology. More importantly is to personally approach archaeology in YouTube videos, which is a common occurrence in individual UGC channels. By personally introducing the viewer to the archaeologists and their experiences with archaeology, the viewer is more likely to actively associate with the hosting archaeologist and engage with the archaeological information the archaeologist presents. It also allows for a much more entertaining setting which is more likely to appeal to the overall viewer on YouTube.

Apart from the archaeological channels that provide accurate and reliable information, YouTube also features archaeological channels that fail to clearly display their (scientific) sources, disseminate inaccurate information or falsely represent the archaeological discipline. The latter type of archaeological channels are mainly operated by treasure hunters and pseudo-archaeologists. A number of pseudo-archaeological channels from the sample are even organized within a single network and collaborate on multiple channels on the platform. YouTube's attempts to prevent the dissemination of misinformation and disinformation on its platform are considered and have proven to be inadequate to achieve this. It is therefore up to the viewer which archaeological content on YouTube is reliable and scientifically accurate. Consequently, this could seriously

impact the general public's perception and understanding of archaeology as well as the overall integrity of the archaeological discipline, if left unattended.

This refers back to the first two considerations described in the aim of this thesis (1. Introduction). According to previous studies, the data set and various observations made during data collection for this thesis, YouTube as an online digital platform offers both opportunities and hazards for archaeological science communication. On one hand, the video format on YouTube varies significantly between the different archaeological channels on the platform and showcases great potential to communicate archaeological science to and with the general public. YouTube is a widely accessible platform for both scientists and the general public that offers a place to discuss and engage with topics related to archaeology with one another. On the other hand, YouTube also offers access to less reliable archaeological channels that disseminate inaccurate archaeological information and incorrectly represent the (scientific) archaeological discipline. So far, little effort is made by YouTube to prevent the dissemination of archaeological misinformation and disinformation on the platform which could pose a potential hazard to the integrity and authenticity of the scientific archaeological discipline.

11. Abstract

This thesis describes and discusses the different archaeological channels that broadcast archaeological content on YouTube. Archaeological channels on the platform provide opportunities for practicing archaeological science communication and for interaction between archaeologists and the general public. For instance, the scientific YouTube channels *Ant Lab* and *Archaeoduck* are great examples of science communication on YouTube. The channel owners, entomologist Smith and archaeologists Duckworth demonstrate that scientific YouTube channels can make science more interesting for the general public and create a closer (and more personal) connection between the viewer and the scientist. Regardless, archaeological channels can also disseminate inaccurate information or incorrectly represent the archaeological discipline. It is therefore important for the archaeological discipline to understand the archaeological content that is currently available on YouTube. On the basis of former research within the field of archaeology and science communication, a data set of 80 different archaeological channels was produced and analysed in this thesis. The content analysis shows an extremely diverse set of archaeological channels that vary in subscriber size, content type, purpose, level of interaction, target audience, content producer, and reliability. Most archaeological channels from the data set provide accurate scientific information and are targeted towards enthusiasts of archaeology. However, apart from a few significant outliers, these scientific archaeological channels remain relatively small in subscriber count in comparison to the other non-scientific archaeological channels. Archaeological channels on YouTube mostly inform or educate their audiences. Yet, a combination of entertaining aspects and (scientific) information is an effective format for reaching larger audiences. Moreover, the content of archaeological channels is produced by individuals, archaeological organisations/institutions, and larger television/documentary networks. Also the level of interaction between channels and viewers varies significantly per channel and suggest that the three main models of science communication (deficit model, dialogue model, and participation model) are each represented on YouTube independently.

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13. Appendix

Channel	UGC - PGC	Organisational UGC	Interaction	Purpose	Subscribers	Content type	Audience	Producer	Reliability
Absolute History	pgc	yes	low	inform	private	Documentary	enthusiast	amateur	high
Adventure Archaeology	ugc		high	entertain	38.400	Lifestyle	enthusiast	novice	low
Amazing Stock	pgc	yes	medium	infotain	641000	Top list	enthusiast	novice	medium
Ancient Americas	ugc		high	inform	49.600	Educational	enthusiast - amateur	amateur	high
Ancient Architects	ugc		high	inform	415000	Educational	amateur	amateur	medium
Ancient Astronaut Archive	ugc		high	inform	262000	Educational	enthusiast	novice	low
ancient1580	ugc		high	infotain	3.410	Lifestyle	enthusiast	expert	high
Andrew Collins	ugc		high	inform	1.180	Online Lecture	enthusiast	novice	low
Andrew White	ugc		high	inform	512	Vlog	amateur	expert	high
Anna Wiman	ugc	yes	low	excite	16	Lifestyle	enthusiast	amateur	high
Antiquity Journal	ugc	yes	low	promote	101	Interview	amateur - expert	expert	high
Archaeological Review from Cambridge	ugc	yes	low	educate	35	Online lecture	expert	expert	high
Archaeologist	ugc		low	excite	96.900	shorts	enthusiast	novice	low
Archaeologists Connected	ugc		low	inform	67	vlog	amateur - expert	expert	high
Archaeology Studio	ugc		high	inform	1.340	Educational	enthusiast	expert	high
Archaeology TV	ugc		low	educate	5.550	Online lecture	expert	expert	high
ArchaeologyLeiden	ugc	yes	low	promote	240	lifestyle	enthusiast	expert	high
Archaeosoup	ugc		high	inform	23.100	podcast	enthusiast - amateur	amateur	medium
Armchair Archaeology	ugc		low	infotain	22	Educational	enthusiast	expert	high
ASOR	ugc	yes	low	educate	1.480	Online lecture	amateur - expert	expert	high
Bamburgh Research Project	ugc	yes	low	educate	577	interview	amateur - expert	expert	high
Blast World Mysteries	ugc		low	inform	private	Educational	enthusiast	novice	low
Boaz Mysteries	pgc	yes	medium	inform	51.300	Documentary	enthusiast	novice	low
Boundary End Archaeology Research Center	ugc	yes	high	educate	645	Online Lecture	expert	expert	high
Brien Foerster	ugc		medium	inform	353000	Lifestyle	enthusiast	novice	medium
British School at Athens	ugc	yes	low	educate	1.600	Online lecture	amateur - expert	expert	high
Cambridge Archaeology	ugc	yes	low	educate	5.660	Online lecture	amateur	expert	high
CambridgeUniversityCaboVerdeArchaeology	ugc	yes	high	inform	private	Lifestyle	enthusiast	expert	high
cf-apps7865	ugc		high	inform	110000	Educational	enthusiast - amateur	novice	low
Cotswold Archaeology	ugc	yes	medium	inform	319	Lifestyle	amateur - expert	expert	high
Crow Canyon Archaeological Center	ugc	yes	low	inform	2.790	Online lecture	amateur - expert	expert	high
Crunch	pgc	yes	high	inform	423000	Top list	enthusiast	novice	low
Dan Davis Author	ugc		high	inform	45.800	Documentary	amateur	amateur	high
Dig it with Raven	ugc		high	infotain	15.400	vlog	enthusiast	expert	high
Dr. Rob's Archaeofilms	ugc		low	educate	415	Online lecture	amateur	expert	high
DTTV - Archaeology	pgc	yes	low	inform	private	Documentary	amateur	novice	low
DTTV - Archaeology Answers	pgc	yes	low	inform	91.900	Documentary	enthusiast	novice	low
Epic Archaeology	ugc		medium	inform	1.470	Online lecture	enthusiast	novice	high
Gone Diggin	ugc		high	entertain	8.210	Lifestyle	enthusiast	novice	low
Harvard Museum of the Ancient Near East	ugc	yes	low	inform	24.700	Online lecture	enthusiast	expert	high
History Time	ugc		medium	inform	710000	Documentary	enthusiast	amateur	high
INEA Project Videos	ugc	yes	low	inform	935	Documentary	enthusiast	expert	high
Inforado	pgc	yes	low	excite	private	Top list	enthusiast	novice	medium
Irish Archaeology Field School	ugc	yes	low	educate	330	Lifestyle	amateur - expert	expert	high
Jamestownrediscovery	ugc	yes	medium	inform	18.300	Lifestyle	amateur - expert	expert	high
Janet Stephens	ugc		medium	educate	57.200	Tutorial	enthusiast - amateur	amateur	high
karl-james langford	ugc		medium	inform	1.700	Online lecture	amateur	expert	high
Kinkella Teaches Archaeology	ugc		high	infotain	2.290	vlog	enthusiast	expert	medium
Lightning Top	ugc	yes	low	excite	private	Top list	enthusiast	novice	low

Matrix Wisdom	pgc	yes	medium	inform	private	Educational	enthusiast	novice	low
megalithomaniaUK	pgc	yes	medium	inform	125000	lifestyle	amateur	amateur	medium
Must Farm Archaeology	ugc	yes	low	inform	468	vlog	enthusiast - amateur	expert	high
Mysterious Middle East	pgc	yes	medium	inform	137000	documentary	enthusiast	novice	low
Nathanael Fosaaen	ugc		high	educate	5.380	vlog	amateur	expert	high
Odyssey - Ancient History Documentaries	pgc	yes	low	educate	139000	Documentary	enthusiast	novice	medium
Origins Explained	pgc	yes	low	excite	3.420.000	Top list	enthusiast	novice	low
Out of Place Discoveries TV	ugc		low	inform	42.300	Online lecture	enthusiast - amateur	novice	low
Penn Museum	ugc	yes	low	inform	62.600	Online lecture	amateur - expert	expert	high
Pete Kelly	ugc		medium	inform	114000	Lifestyle	enthusiast	amateur	high
Rachelamun	ugc		high	infotain	3.920	vlog	enthusiast	expert	high
Recording Archaeology	ugc	yes	low	educate	6.130	Online lecture	expert	expert	high
Retail Archaeology	ugc		medium	entertain	106000	Lifestyle	enthusiast	novice	low
Rosie Crawford	ugc		high	infotain	16.500	Lifestyle	enthusiast	expert	medium
Skallagrim	ugc		medium	infotain	1.480.000	vlog	enthusiast	amateur	medium
Smarthistory	pgc	yes	low	inform	234000	Educational	enthusiast	expert	high
Society of Black Archaeologists	ugc	yes	low	excite	73	vlog	amateur	expert	high
Stefan Milo	ugc		high	inform	135000	Educational	amateur	amateur	high
Study of Antiquity and the Middle Ages	pgc	yes	medium	inform	154000	Documentary	amateur	amateur	medium
Talmadge Gerald	ugc		high	excite	254	Lifestyle	enthusiast	expert	high
The Archaeology Channel	pgc	yes	low	excite	268.000	promotional	enthusiast	expert	high
The Armchair Archaeologist	ugc		low	inform	35	Educational	amateur	expert	high
The British Museum	pgc	yes	low	inform	515000	Educational	enthusiast	expert	high
The Histocrat	ugc		medium	inform	242000	Educational	amateur	amateur	high
Time Team Classics	pgc	yes	low	infotain	151000	Documentary	enthusiast - amateur	expert	high
Timeline - World History Documentaries	pgc	yes	low	inform	3.240.000	Documentary	enthusiast	novice	high
toldinstone	ugc		high	inform	143000	Educational	enthusiast - amateur	expert	high
TREY the explainer	ugc		low	infotain	753000	Educational	enthusiast	amateur	high
Vintage Egyptologist	ugc		low	inform	64.800	vlog	enthusiast - amateur	expert	high
Viral History	pgc	yes	high	inform	3.720	vlog	enthusiast	expert	high
World of Antiquity	ugc		high	inform	20.600	shorts	enthusiast	expert	high

Channel	Hyperlink
Absolute History	https://www.youtube.com/channel/UCr5qeBG9g7bGtMGyHG2GzbQ
Adventure Archaeology	https://www.youtube.com/c/southerndiggers
Amazing Stock	https://www.youtube.com/channel/UCL08hFP0GceHgZ2UhThJAIA
Ancient Americas	https://www.youtube.com/channel/UCEqNbbsx0i7fhwRt0saYIcQ
Ancient Architects	https://www.youtube.com/c/AncientArchitects
Ancient Astronaut Archive	https://www.youtube.com/c/AncientAstronautArchive
ancient1580	https://www.youtube.com/user/ancient1580
Andrew Collins	https://www.youtube.com/channel/UCV4_zE8kqVzQ-KSAArA5EMg
Andrew White	https://www.youtube.com/channel/UCbZm-RwXrw4SMOYYEQzeJkA
Anna Wiman	https://www.youtube.com/channel/UCAqxPdv-XTl2F_bOEAnE_6g
Antiquity Journal	https://www.youtube.com/channel/UCqsrJpzBSwfdgC6hNAcHMlw
Archaeological Review from Cambridge	https://www.youtube.com/channel/UC7vHUJyNFdQLveNbSHjOSSg
Archaeologist	https://www.youtube.com/channel/UC3QlTVvR2n43erGl33Zvpyw
Archaeologists Connected	https://www.youtube.com/channel/UCeeZhSNKceijIhh2ozxVahg
Archaeology Studio	https://www.youtube.com/c/ArchaeologyStudio
Archaeology TV	https://www.youtube.com/c/ArchaeologyTV
ArchaeologyLeiden	https://www.youtube.com/user/ArchaeologyLeiden
Archaeosoup	https://www.youtube.com/channel/UCiJCpRC9BvG-xIlYImiNN0g
Armchair Archaeology	https://www.youtube.com/channel/UC7kqdtFZTveVfEt_DNtigtw
ASOR	https://www.youtube.com/c/AsorOrg_plus
Bamburgh Research Project	https://www.youtube.com/user/bamburghmedia
Blast World Mysteries	https://www.youtube.com/channel/UCyzMfHww70rsY9bYcB4O8Bw
Boaz Mysteries	https://www.youtube.com/c/BoazMysteries
Boundary End Archaeology Research Center	https://www.youtube.com/c/BoundaryEndArchaeologyResearchCenter
Brien Foerster	https://www.youtube.com/c/brienfoerster
British School at Athens	https://www.youtube.com/channel/UCJLq-d0Q3Upn28hO5UWptmw
Cambridge Archaeology	https://www.youtube.com/c/CambridgeArchaeology
CambridgeUniversityCaboVerdeArchaeology	https://www.youtube.com/channel/UCia5s-X0SSUi9rmkbijt-mg
cf-apps7865	https://www.youtube.com/c/cfapps7865
Cotswold Archaeology	https://www.youtube.com/c/CotswoldArchaeology
Crow Canyon Archaeological Center	https://www.youtube.com/user/CrowCanyonConnects
Crunch	https://www.youtube.com/c/CrunchScience
Dan Davis Author	https://www.youtube.com/c/DanDavisAuthorChannel
Dig it with Raven	https://www.youtube.com/channel/UC6P0a1_YLM0i2LoLmP9jCRw
Dr. Rob's Archaeofilms	https://www.youtube.com/channel/UCJNUixg4wDw_lyjY9t5z7hA
DTTV - Archaeology	https://www.youtube.com/channel/UCCC5ejLIQRu3c2E-5ytlGqw
DTTV - Archaeology Answers	https://www.youtube.com/c/DTTVArchaeologyAnswersFilms
Epic Archaeology	https://www.youtube.com/channel/UC9RYeWjjb5kwq40BEGjyJhg
Gone Diggin	https://www.youtube.com/c/GoneDiggin
Harvard Museum of the Ancient Near East	https://www.youtube.com/c/HarvardMuseumoftheAncientNearEast
History Time	https://www.youtube.com/c/HistoryTime
INEA Project Videos	https://www.youtube.com/channel/UCYEex7fCd2UvELn9IpSYg_g
Inforado	https://www.youtube.com/channel/UC4RAMFWcoaKEBEgWBXw2HRQ/featured
Irish Archaeology Field School	https://www.youtube.com/c/IrishArchaeologyFieldSchool
Jamestownrediscovery	https://www.youtube.com/c/JamestownRediscovery
Janet Stephens	https://www.youtube.com/user/jntvstp
karl-james langford	https://www.youtube.com/user/karljlangford
Kinkella Teaches Archaeology	https://www.youtube.com/c/KinkellaTeachesArchaeology
Lightning Top	https://www.youtube.com/channel/UCq_wtV2N7LV1TXiFBXJnHIA/featured
Matrix Wisdom	https://www.youtube.com/c/MatrixWisdom/featured
megalithomaniaUK	https://www.youtube.com/user/MegalithomaniaUK
Must Farm Archaeology	https://www.youtube.com/channel/UCqosTrrGOPNTcqy7Kmsu6vQ
Mysterious Middle East	https://www.youtube.com/c/MysteriousMiddleEast
Nathanael Fosaaen	https://www.youtube.com/c/NathanaelFosaaen

Odyssey - Ancient History Documentaries	https://www.youtube.com/c/odyssey
Origins Explained	https://www.youtube.com/c/OriginsExplained/videos
Out of Place Discoveries TV	https://www.youtube.com/channel/UC9trK9k-6gr2JspzAmtB2xQ
Penn Museum	https://www.youtube.com/c/PennMuseumPhiladelphia
Pete Kelly	https://www.youtube.com/c/PeteKellyHistory/videos
Rachelamun	https://www.youtube.com/c/Rachelamun_Archaeologist
Recording Archaeology	https://www.youtube.com/c/RecordingArchaeologyVideos
Retail Archaeology	https://www.youtube.com/c/RetailArchaeology
Rosie Crawford	https://www.youtube.com/c/RosieCrawford
Skallagrim	https://www.youtube.com/c/Skallagrim
Smarthistory	https://www.youtube.com/user/smarthistoryvideos
Society of Black Archaeologists	https://www.youtube.com/channel/UCl0RdLwgqrRCcFZZm-4Hs4A
Stefan Milo	https://www.youtube.com/c/StefanMilo
Study of Antiquity and the Middle Ages	https://www.youtube.com/c/TheStudyofAntiquityandtheMiddleAges
Talmadge Gerald	https://www.youtube.com/channel/UCsFmjKgHyK9_KGQL5qYha1Q
The Archaeology Channel	https://www.youtube.com/c/TheArchaeologyChannel
The Armchair Archaeologist	https://www.youtube.com/channel/UCcD561KCMmYlPGD4e9mX-sw
The British Museum	https://www.youtube.com/user/britishmuseum
The Histocrat	https://www.youtube.com/c/TheHistocrat
Time Team Classics	https://www.youtube.com/c/TimeTeamClassics
Timeline - World History Documentaries	https://www.youtube.com/c/TimelineChannel
toldinstone	https://www.youtube.com/c/toldinstone
TREY the explainer	https://www.youtube.com/c/TREYtheExplainer
Vintage Egyptologist	https://www.youtube.com/c/VintageEgyptologist
Viral History	https://www.youtube.com/c/ViralHistory
World of Antiquity	https://www.youtube.com/c/WorldofAntiquity