Bitcoin – A new medium

19. Oktober 2015

10. semester
Interaktive digitale medier
Aalborg Universitet

Udarbejdet af Thor Larsen

Vejleder: Thomas Borchmann

Sideantal: 108 sider
Anslag: 190.553 (79,4 sider)

AALBORG UNIVERSITY
STUDENT REPORT

Abstract

In this master thesis, the author acknowledges Bitcoin as a novel phenomenon with paradigm shifting potential. As such, a need to define and study this phenomenon and enter into a discussion about the nature of this artefact. The author is motivated in this enterprise by personal involvement into the communities surrounding its development and discussion of its possible implications.

The goal of the thesis is to be able to contribute both with knowledge and in the on going discourse relating to Bitcoin. Two products can be extraprolated from this. First a need to produce academic information about the phenomenon at large. Secondly, an informational product is sought to be published, containing the information of the academic product, which might then enter into the discussion about Bitcoin in order to further knowledge to the public about the phenomenon.

This is undertaken in a thematic manner, where the phenomenon of Bitcoin is discussed and analyzed in light of several aspects, which will address the main research question of the thesis: what is the Bitcoin phenomenon? Answering the question a wide modality of research questions are addressed. These are as follows:

- What is Bitcoin?
- How might Bitcoin be viewed in a basic media-historical perspective?
- In light of this perspective, which properties and qualities might be revealed from defining Bitcoin as a novel medium?
- Based upon the definition of Bitcoin as a medium, how might a conceptual framework be structured to understand the phenomenon?
- How might answering these research questions contribute to more public awareness and understanding in regards to the Bitcoin phenomenon?

These questions are addressed in light of relevant theory with each subsequent question informing the next. Key perspectives and theories presented and discussed, in the context of Bitcoin, are Irving Fang and McLuhan, as well as several contemporary media scholars. To create a preliminary understanding of Bitcoin, selected research was chosen as well as the original whitepaper. Answering these questions, Bitcoin is both defined as a virtual, interactive medium and a phenomenon due to its open source, transparent development community. It is also readily available for remediation, a concept derived from McLuhan, which also contributes to what the author sees as the phenomenon. Through the qualities and properties of the medium, an ecosystem is created to describe the phenomenon. The author concludes that Bitcoin is part of a decentralized information megatrend, or in the perspective of Irving Fang, a 7th information revolution.

TABLE OF CONTENTS

CHAPTER I – INTRODUCTION AND METHODOLOGY

1.1 Introduction

The subject of this thesis is the phenomenon Bitcoin. Bitcoin can be described as an intangible phenomenon, which have tangible, real world value and impact.

Let us for a moment investigate the intangibility of Bitcoin, for it holds two meanings. It is, for the most part, incapable of being perceived by the sense of touch as it is a virtual phenomenon, therefor in one sense, intangible. Secondly, for most people it is unclear to the mind exactly what Bitcoin is and what it represents, meaning that the phenomenon is a rather intangible system of different elements. However, one can choose to focus solely on its function as a currency and gain a great understanding of this function, but this will not yield the whole picture, or even explain some of the dramatic media coverage. One such dramatic headline could be, "Jamaican bobsled team sponsored by dogecoins."

Early 2014 the Dogecoin community rallied behind the Jamaican bobsled team in order to complete their crowdfunding goal of $80.000 by raising $30.000. Dogecoin is based on the popular doge meme, founded by IBM engineer Billy Markus and Jackson Palmer (Hern, 2014). While bitcoins[1] and dogecoins are two different 'crypto currencies', they are both based on the same prototype protocol, and thus share the same system. Though the question remains, how can a virtual currency based of off a meme get a Jamaican bobsled team to Sochi for the winter Olympics? Somehow, real tangible value was created. As such, the author believes this constitutes an interesting phenomenon worthy of scientific enquiry.

For most people, the phenomenon first appeared in March month, 2013 as it caught the attention of the media by rapidly raising in monetary value. On the surface, the Bitcoin phenomenon can be described as a peer-to-peer, decentralized medium for currency transactions. In this manner, any individual with a computer is able to send or receive money anonymously from anywhere in the world in a few moments, without paying the fee that comes with including a third-party institute to facilitate the transaction. However, Bitcoin is more than just money, and this thesis will focus on Bitcoin as a phenomenon for exchanging information and creating value over the internet.

The author is of the conviction that the study of the development and usage of innovative media technology is of absolute importance in a culture where this technology and its mediated content is ubiquitous and pervasive in every aspect of life. As modern society is increasingly being mediated by technology, so increases the need to understand the consequences of this. Understanding the importance of these technologies in everyday life is ultimately to understand what characterizes the modern, hyper-complex society. Paying homage to Mcluhan, this thesis is not so concerned with the content of the medium, as it is on the impact of its use and dissemination onto society.

---

[1] Bitcoin with lower case refers to the currency, while upper case refers to the Bitcoin protocol.

The personal drive behind the choice to focus on the Bitcoin phenomenon has fostered over a longer period, as it for some time has been a great interest to the author. Both as a disruptive technology, with seemingly unlimited possibilities, and a flagship for an online cultural movement. Through this interest in this subject, the author has gained considerable personal experience with the usage of Bitcoin, its open-source continual development environment, and the culture that the phenomenon has inspired. Through this process and the dialogues it generated, both in digital as well as physical forums, the author has first-hand experience with the uncertainty and ignorance the non tech-savvy public demonstrate with regards to the phenomenon. Rightfully so, it is hard to understand how value apparently materialized in the introductory bobsled example.

Why the author believes Bitcoin as a decentralized, peer-to-peer technology is important to study can be summarized in few, largely self-explanatory bullet points:

- Decentralized media technology is inherently neutral, completely circumventing discriminatory topics such as nationality, sexuality, race, religious belief or wealth. The implication of this being an unprecedented degree of equality. Additionally, technology is incorruptible on a moral level, meaning that
- In the same manner as technology is neutral, decentralized peer-to-peer networks allow users or individuals to transact and communicate directly to one another without a third party gatekeeper, enabling true free speech and trade.
- Bitcoin, as with many other decentralized technologies, are open-source, which ensures a level of scrutiny, transparency, and accountability, which is absent with conventional, proprietary and centralized media technologies
- In the same vein as the open-source scrutiny, privacy is protected to an unprecedented degree as no centralized entity holds sensitive user data, which also means that no central authority may monetize on this data.
- I look upon Bitcoin as a precursor, an avant-garde, prototypical manifestation of a decentralized media technology revolution. As such, I consider Bitcoin to be a prototype or a taste of what is to come.

Raised pitchforks in the face of novelty and change is nothing new, and the complex nature of Bitcoin is only adding to its alienation. Moreover, advocates of Bitcoin often focus on specific elements or properties within the Bitcoin phenomenon, while failing to convey a complete picture of the phenomenon. These same advocates are also usually highly biased for or against Bitcoin, while being themselves deeply involved in the hacker culture, to whom the intrinsic complexities of the Bitcoin system probably appears rather intelligible. The author believe this combination is unfortunate when trying to convey to the larger public, what the Bitcoin phenomenon is. An imperative of this thesis is to understand create an understanding of this novel technology, its embedded cultural and possibly paradigm shifting implications. The intended product of this

is an inherently better understand of the phenomenon, while also providing a useful framework towards future research endeavors.

1.2 Research Questions and goals

Following the introduction, the overarching question that is sought answered should represent itself as: **what is the Bitcoin phenomenon?** This abstract question will drive the development of this thesis, referred to as the main research question.

Two derivatives might be extrapolated from this statement. Most prominently, the need to understand the medium, which necessitates a basic theoretic framework. Also, it requires a paradigm from which to encompass what is considered the Bitcoin phenomenon and a structure to frame and organize the phenomenon into. That is, in order to comprehend and delimit what is designated the phenomenon and its impact or importance, a conceptual framework must be developed, based upon a definition of Bitcoin as a medium and the qualities and properties this definition might elucidate.

However, due to the novelty of the concept of Bitcoin and subsequently the phenomenon, addressing the overarching research question necessitates a comprehensive preliminary research phase, which implies reviewing existing research literature, in addition to examining the original white paper detailing the concept. Following this, the point of departure must be to investigate and discuss Bitcoin in a historical and cultural context, because, as prior discussed, nothing exists in a vacuum, without cultural ties to existing concepts and phenomena. The point of departure then becomes one of basic theoretical and media historical discussion, the product of which will be the knowledge necessary to ask theory grounded questions, through scientific optics.

As will become apparent, the following research questions will be of a rather open-ended nature. This is done to allow the preceding question to be informed by the former to promote contextual relations in order to produce a comprehensive answer to the overarching research question, what is the Bitcoin phenomenon? The research questions are stated as follows:

1. **What is Bitcoin?**

2. **How might Bitcoin be viewed in a basic media-historical perspective?**

3. **In light of this perspective, which properties and qualities might be revealed from defining Bitcoin as a novel medium?**

4. **Based upon the definition of Bitcoin as a medium, how might a conceptual framework to understand the phenomenon look like?**

5. **How might answering these research questions contribute to more public awareness and understanding in regards to the Bitcoin phenomenon?**

These research questions are largely derived from the author's subjective experience in the space of Bitcoin development and discourse (from both academic literature as well as social platforms), omitting a large preliminary research phase, which becomes practically imprudent. As such, they represent informed curiosity regarding less discussed and to some degree overlooked, yet important aspect of the phenomenon from the author's perspective. The stated research questions are interlinked in such a manner that they inform one another, and progressively construct an answer to the overarching question, what is the Bitcoin phenomenon. Initially, a basic introduction is required (research question no. 1). In this process both the concept of media in a historical context, as well as the notion of a novel media technology (research question no. 2-3), in the context of Bitcoin, will be constructed. This will serve as a foundation to further explore the phenomenon of Bitcoin and conceptualize a framework (research question no. 4). Based on the understand derived from the preceding questions, it will be discussed how this knowledge might be disseminated and enter into the current dialog about Bitcoin with the purpose of creating greater understanding for the phenomenon (research question no. 5).

The goal of this undertaking becomes to gain an understanding of the phenomenon at large, within the boundaries of the academic realm of Interactive Digital Media, Aalborg University. The yield of this enquiry will serve as a practical informational product. Two clearly distinct products or goal statements might be identified from this:

- **An academic product: creation of a theoretic definition and framework from which to define and understand the Bitcoin phenomenon.**
- **A practical product: the creation of a publicly available information product based on the academic product to promote knowledge about the Bitcoin phenomenon.**

1.3 Thesis focus clarification

While Bitcoin itself (the protocol) is rather simple to understand, what has grown around it becomes another matter to address. This issue somewhat similar to the internet protocol. The internet protocol allows for transmitting information, while the bitcoin protocol allows for transmitting value using the internet. However, if prompted with the question, what is the internet? It usually refers to the wealth of services, information and interconnectivity between millions interactive digital artefacts, users and actors of such, World Wide Web and Wikipedia. The same way as all of this can be referred to as a phenomenon, enabled by the internet protocol, so is Bitcoin enabling a phenomenon, which is growing faster than ever.

Thus, understanding the Bitcoin phenomenon necessarily entails enquiry into more than simply the nature, properties and qualities of the protocol. The development environment, individuals and actors interacting through the network on a global scale, creating services which interface with and alters the face of the protocol and how it is represented, might as a whole be considered the Bitcoin space. Without this interaction through the medium, by users and actors on many levels, Bitcoin would simply be a piece of obscure software, which cannot be considered a phenomenon worthy of scientific enquiry.

The verb of phenomenon, from the Greek *phainnomenon*, *phainein,* translates into "to appear", or "to manifest itself" (Phenomenon, 2015). Thus, phenomena is understood as appearances or experiences that are not readily comprehensible. As such, Bitcoin is considered a phenomenon. Not only the software protocol itself, but the digital and social environment, which appears to have organically grown around it. According to Kant (1770), phenomena refers to any incident that is of distinctive or unusual importance and thus deserving of enquiry. The sentiment of Bitcoin in this text reflects Kant's definition of phenomena and Bitcoin is considered worthy of scientific enquiry. Perceiving the artefact as a medium, which enables the formation of what one might call the Bitcoin space around it thus becomes what is considered the Bitcoin phenomenon.

This section seeks to explicit the goals and assumptions, while defining the thematic and academic boundaries of this master thesis. In addition, the thesis goal will be framed within what is considered an important context. The issue that is sought highlighted in the introduction can be described as an astonishment in regards to the academic and public knowledge conditions surrounding the Bitcoin phenomenon. The decision to work with this issue is driven by an ambition to partake in an ongoing enterprise to alleviate the perceived uncertainties in regards to this new phenomenon, as it pertains to understanding it. In addition, Bitcoin itself is merely a prototype of what, in this text, is considered a highly disruptive technology, and understanding the onset of innovative technology based upon this becomes an imperative.

> *"As the introduction of a disruptive technology involves many and various players, some*
> *of whom may not be involved in a technological sense, such as legislators, their*
> *networking and dialogue is an important infrastructural consideration in order to pave*

the way for a coordinated introduction of a new technology, rather than a collision with
unintended barriers. (Dini, et al., 2010, p. 9)

While this excerpt, from an EU commissioned study, pertains to disruptive technologies in relation to digital business ecosystems, it portrays the importance of understanding such technologies in order to avoid unintended collisions. As will become clear through this text, these concerns apply to Bitcoin. It bears mentioning that the potential behind the Bitcoin protocol is not limited to the realm of economics, but rather seems to provide a basic framework for mediating value over the internet in a decentralized, anonymous manner. It is a base assumption that the open source protocol of Bitcoin sets the stage for innovation in many directions in general area of informatics. It should be noted however, that this has been happening, and continues to happen, in obvious and not so obvious ways. Following this, an imperative and ideal with working with this topic becomes to distribute and educate knowledge pertaining to the phenomenon of Bitcoin.

The goal then, becomes to gain an understanding by means of explorative scientific enquiry into the nature of the phenomenon at large, within the boundaries of the academic realm of Interactive Digital Media, Aalborg University. This education is focused on new media technologies and the way in which they enable interactivity, and thereby create relations and experiences for the users. As such, the subject area are these new media technologies, their theoretic basis, reproduction, distribution, use and meaning.

Interactive Digital Media appears to be an appropriate academic discipline from which to undertake an enquiry into a phenomenon that appears to be one such, a media technology. Relying on an established basic theoretic framework is a necessity. Consider the following statement by the assumed inventor of Bitcoin, when prompted with the task of explaining it:

"Sorry to be a wet blanket, but writing a description of Bitcoin for general purposes is
bloody hard. There is nothing to relate it to." Satoshi Nakamoto, July 5, 2010

It appears hard to readily compare or relate Bitcoin to any easily comprehensible concepts, and even harder to compare the phenomenon of Bitcoin to anything. However, it is the belief of the author that nothing exists in a cultural vacuum. As such, Bitcoin has cultural relations to existing artefacts. Recognizing this, the point of departure into understanding this phenomenon is the basic media theory of Marshall McLuhan. A general assumption of this thesis is that Bitcoin can be perceived as such, a medium. Perceiving Bitcoin as a medium becomes the cultural relation through which an understanding of the phenomenon will be created.

The McLuhanite idea that media technologies have a profound effect on the individual and culture, the ideal that it is not the content of a medium that is important, but the impact. Rather, it is the scale of change and impact it has on society, as a whole, that we should concern ourselves with:

"... in operational and practical fact, the medium is the message. This is merely to say that the personal and social consequences of any medium, that is, of any extension of ourselves-result from the new scale that is introduced into our affairs by each extension of ourselves, or by any new technology […]" (McLuhan, 1964, p. 49)

This ideal is reflected in the academic discipline of Interactive Digital Media, in addition to satisfying the curiosity which drives the author in this research undertaking. As such, the basic media theories of Marshall McLuhan act as a philosophical scope from which to investigate and guide the scientific enquiry of this thesis. The prevalence of this media philosophy into the postmodern, information age is rather compelling and I believe this scope will yield valuable information. Understanding Bitcoin as a medium might serve as a gateway to understanding the phenomenon, which appears to have sprung from it. Indeed, Bitcoin is considered a novel, exciting medium.

Following this, the scope can be described as the tension between the social and the technical sciences. However, the author is not blind to the fact that Bitcoin is a form of money, and the mainstream concept of money is everything but trivial. Because the inclusion of this dimension would require specialized economic expertise, the author will attempt to exclude this field as much as possible with the exception of defining money within the chosen media theoretic paradigm. Questions and comparisons pertaining the nature of money in general will forego examination. An expanding body of research into the economic nature of Bitcoin already exists. Following this logic, topics such as politics, economics and technical computer science is beyond the scope, and will only be touched upon to the extend they illuminate aspects of Bitcoin pertaining to the research questions and the overall scope.

1.4 Thesis Structure & Methodology

This sections seeks to elucidate the scientific methodology by which this thesis is developed and justify the project design that is demanded hereby. The purpose of this is to make a strong methodological foundation from which to validate the results of the process stemming hereby. The contents of this section is limited to general, overall methodology, whereas implicit and more immediate considerations will be discussed at appropriate junctures in the narrative of the thesis. Discussing general creative methodology, including an eclectic acknowledgement, in light of the phenomenon at large, can be found in the appendix (no. 1).

Structure

Research questions no. 2-3 affords theoretic discussion based on relevant literature (the academic product), while research question no. 5 is a matter of practical production (the practical product). The logic demanded by the academic product might be illustrated. The object of inquiry is Bitcoin, and is thus based at the center of the model. The layers, represented by the research questions, are added in order to create contextual references from which to create knowledge about the object of enquiry. First research question becomes an overarching context, or theoretic optic, from which to observe Bitcoin. Included within this context, second and third research question overlaps in a Venn-diagram fashion to produce knowledge about Bitcoin in the context dictated research question no. 2. In this case, the Venn is utilized as a means to describe the simple logic of two overlapping research questions, which defines and comprise the rationale behind answering the main research question. Such structure is illustrated in the model below (figur 1):

Media theoretic and historical context

Bitcoin defined as a new medium

BITCOIN

Conceptual framework describing the phenomenon of Bitcoin
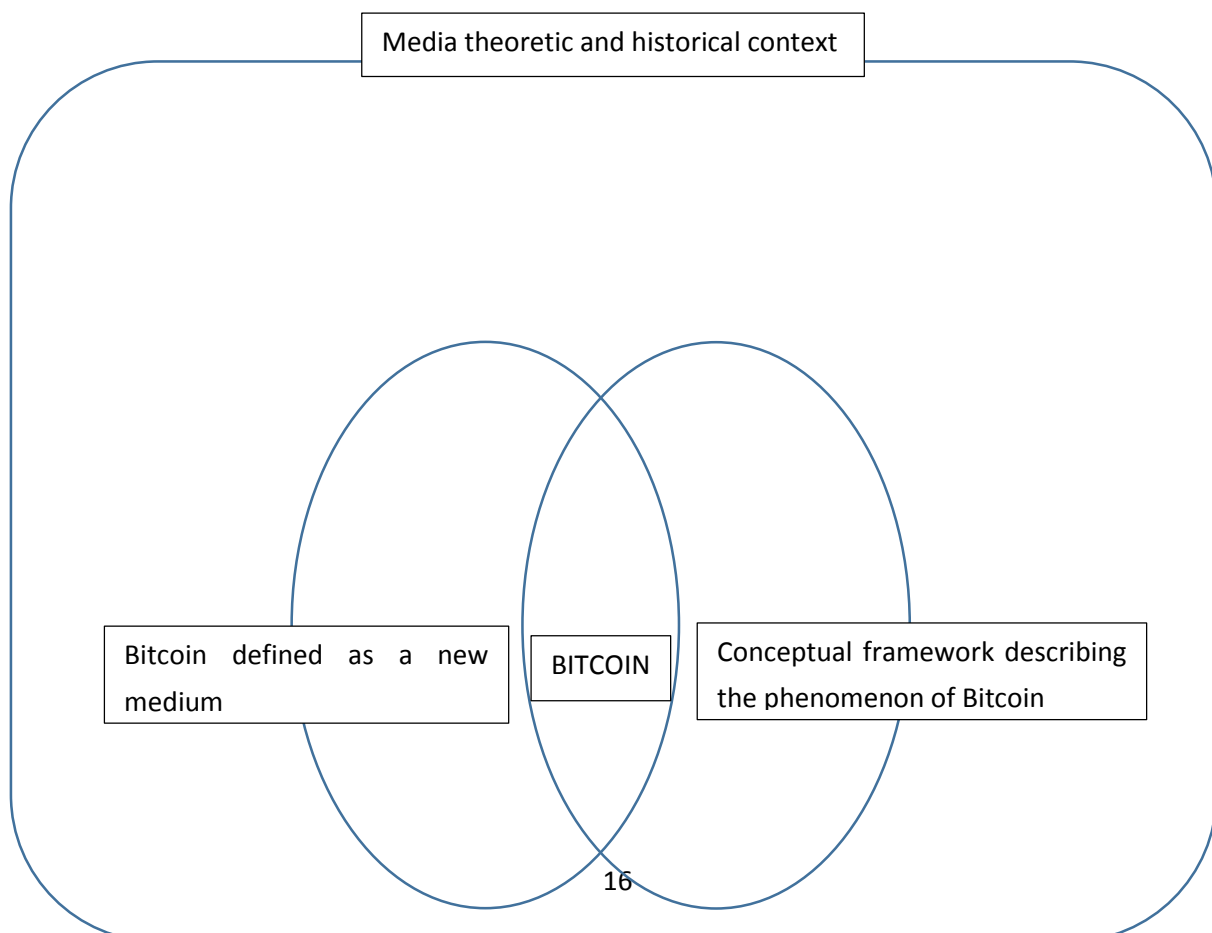
Figur 1

The model describes in an abstract manner how the research questions are interrelated and comprise a holistic attempt at describing the phenomenon of Bitcoin. As is evident, the relation between the research questions might be described as a prerequisite dependence, and therefore also, affording a chronological order of processing. As such, each research question will be addressed in a separate chapter, which is completed with a partial conclusion. In addition to informing the subsequent chapter, these partial conclusions will ultimately synthesize to conclude the academic product, addressing the main research question, and compose the information contained within the practical product. As such, each subsequent chapter hereafter will address a research question in the prescribed order, informed by the previous. This is illustrated in the model below (figure 2):

1. What is Bitcoin? (Chapter II)

2. How might Bitcoin be viewed in a basic media-historical perspective? (Chapter III)

3. In light of this perspective, which properties and qualities might be revealed from defining Bitcoin as a novel medium? (Chapter IV)

4. Based upon the definition of Bitcoin as a medium, how might a conceptual framework be structured to understand the phenomenon? (Chapter V)

5. How might answering these research questions contribute to more public awareness and understanding in regards to the Bitcoin phenomenon? (Chapter VI)

Figur 2

1.5 Critical realism

This section seeks to elucidate the scientific methodology by which this thesis is developed and justify the project design that is demanded hereby. The chronology of this section is structured from philosophical scientific underpinnings to discussing design of the thesis. The purpose of this is to make a strong methodological foundation from which to validate the results of the process stemming hereby. The contents of this section is limited to general, overall methodology, whereas implicit and more immediate considerations will be discussed at appropriate junctures in the narrative of the thesis.

Critical realism will be the scientific scope through which this thesis this thesis aims to produce knowledge about the phenomenon. In the 70'es Roy Bhaskar formulated the basic ontological question critical realism regarding how the world must be in order for science to be able to describe it. The nature of science paradigms are signified not by the methodological approach but by belief systems based on ontological and epistemological assumptions, guiding world view and investigation (Guba & Lincoln, 1994). That is, enquiry into a phenomenon must be guided by epistemology and ontological based world views, which predetermine the methodology by which the phenomenon is investigated. The question of ontology concerns itself with the form and nature of reality, and in extension hereof, what might be known about it, while the epistemological question revolves around the nature of knowledge and how it might be acquired. Subsequently, these philosophical concepts must be discussed in light of the chosen paradigm.

Critical realism affords a practical approach in relation to investigate the phenomenon at large, which exists and ties into complex societal relations in disruptive ways. In *The possibility of Naturalism* (1978) Roy Bhaskar introduced critical realism as an alternative to contemporary approaches as it positions itself critical to both social constructivism and positivism (Wad, 2006), thus describes an interface between the natural and social worlds of science. As a result of this, critical realism has both a realistic view, expressed in its ontology, and a constructivism view, expressed in its epistemology. Accordingly, realism exists in the social world dependent on available knowledge, which is the ontological perspective. The available or existing knowledge might be faulty or theory laden, but it is yet considered possible to gain knowledge about the social reality, which is the epistemological understanding. The creation or production of knowledge then, is looked upon as a social activity (Wad, 2006). In summary, the social world exists independently from the knowledge we have about it (the ontological question). Thus, the existing knowledge that we do have may be both erroneous and theory-driven (the epistemological question). The worldview of critical realism is based off of three main assumptions; reality exists independently from our knowledge about it, it is possible to gain knowledge of this reality through social interaction, and this knowledge is inherently erroneous and thus open for correction. Through the lens of critical realism, the author will argue that it is possible to gain knowledge about the phenomenon at large by exploring it in a scientific manner, while realizing the produced knowledge might be erroneous and thus subject for correction. Furthermore, this is seen as an inherent property of Bitcoin, as it is a rapidly developing, prototypical concept, subject to constant change and adaption.

As an extension of this acknowledgement, the assumption that reality exists without our knowledge hereof, critical realism differentiates between two dimensions of reality: the *transitive* and the *intransitive* dimension. The transitive dimension consists of knowledge that already exists, and this include concepts, theories, methods and data. In contrast, the intransitive dimension represents what is sought knowledge about (Wad, 2006). In the optic of this thesis, the phenomenon of Bitcoin represents an intransitive dimension of reality, which it is sought to illuminate and create knowledge about, using theories and observations from the transitive dimension of reality. As such, the fundamentals of critical realism is reflected in this approach.

In addition to the two dimensions of reality, critical realism distinguishes between three domains of reality. Critical realism argues that an ontological distinction between scientific laws and patterns of events exist, making events and mechanisms independent entities. Furthermore, Bhaskar notes that such events must occur independently from the experiences in which they are captured, making mechanisms are real and distinct from the events they appear to produce, in addition to the experiences in which they are apprehended (Bhaskar, 1978, pp. 13 & 56). Following this, mechanisms, events and experiences thus constitute overlapping domains, describing reality or rather a multi-level ontology. These are referred to as the domains of the *real*, the *actual* and the *empirical*.

- Domain of the real consists of the mechanisms and structures that produce the observed phenomena.
- Domain of the actual consists of the phenomena that occurs independently of being observed or not.
- Domain of the empirical consists of experiences (2006, Wad)

The subset inclusion and relation between these domains are visualized in the reproduced model below (Bhaskar, 1978, p. 13):

	Domain of real	Domain of actual	Domain of empirical
Mechanisms	x		
Events	x	x	
Experiences	x	x	x

As is evident from the above model, the domain of the empirical entail only a limited part of reality, as phenomena may exist without being observed. As such, the purpose of critical realism from a science perspective, is to make it possible to explain a given phenomenon on the basis of generative mechanisms that are bound to a certain structure within a given social context (Wad, 2006).

As prior mentioned, the production of knowledge is looked upon as social activity, and social phenomena cannot be examined in a vacuum. Because of this is it impossible to deduce causal regularities (as it is in positivism sciences). In critical realism it is however possible to deduce casual potentials and tendencies, within a given context. In acknowledgement of this limitation, it is not the intention of the thesis to produce causal regularities or formal predictions about the future of Bitcoin development and meaning. The intent instead is to discuss and apply meaningful theory and perspectives in order to interpret and explain the phenomenon and to approach a definition in a media theoretic context, which is subject to correction and further development.

CHAPTER II – PRELIMINARY DESCRIPTION AND CONCEPTUAL CLARIFICATIONS

2.1 Chapter Introduction

As stated in the prior chapter, a strong need to define and understand the Bitcoin phenomenon exists. This chapter will build further onto that notion by examining the original Bitcoin White Paper by the entity Satoshi Nakamoto, along with the technologies encompassed within. Following the review of the white paper, which grants a preliminary, but admittedly superficial, understanding of the technology and the idea, a short review of relevant research will be conducted. In order to build upon the scientific body of research that already exists regarding Bitcoin. A brief section will be dedicated to gathering and reviewing such literature that is considered to fall within the area of interest and academic scope.

Additionally, the purpose of this chapter is also to provide a necessary conceptual clarification of the cross-disciplinary and, in some cases, rather novel employed terminology regarding similarly new concepts. Instead of a formal section discussing these, they will instead be embedded into the narrative of this chapter and following chapters. As such, the goal of this chapter is to gain a greater understanding of the phenomenon by means of studying the white paper and reviewing a small body of Bitcoin-focused research that lends itself well to the scope of this text. Present chapter will address the first part of the stated research questions, what is Bitcoin?

2.2 Bitcoin White Paper

The method by which this short introduction to the Bitcoin protocol is carried out is simply by examining the original white paper document, which details the basics. In addition, the technologies, which are not detailed herein, will be elucidated. The author will comment on certain aspects of this section from autoethnographic experience when it might illuminate a certain characteristic or issue. The white paper describes the original draft of the Bitcoin protocol, which is considered grey literature, defined as academic literature that is not formally published. The purpose of such papers are generally to help readers understand an issue and propose a solution to said issue. Further, a Bitcoin-focused Wikipedia knowledge base is referenced to explain some of the more intricate aspect of Bitcoin and its technology.

Bitcoin is considered to be the first implementation of a concept referred to as crypto currency, which is a means of secure exchange of data, made possible by principles of cryptography. The first inception of this idea was published in 2008 by an entity called Satoshi Nakamoto to a cryptography mailing list. The white paper was titled *Bitcoin: A Peer-to-Peer Electronic Cash System* (Nakamoto, 2008). The entity, named Satoshi, left the project late 2010 without revealing his identity ("Satoshi Nakamoto", 2015). The fact that the founder or founders of the Bitcoin protocol are unknown, have given rise to a lot of speculation and uncertainty about the technology, yet the actual protocol is developed in an open-source, and thus transparent environment. Because the identity or identities behind what is considered a pseudonym is unknown, Satoshi Nakamoto is referred to as an entity. This section will be focused on and prefaced by examining the original white paper, describing the Bitcoin protocol:

> *"While the [conventional digital transaction] system works well enough for most*
> *transactions, it still suffers from the inherent weaknesses of the trust based model.*
> *Completely non-reversible transactions are not really possible, since financial institutions*
> *cannot avoid mediating disputes. The cost of mediation increases transaction costs,*
> *limiting the minimum practical transaction size and cutting off the possibility for small*
> *casual transactions, and there is a broader cost in the loss of ability to make non-*
> *reversible payments for non-reversible services. With the possibility of reversal, the need*
> *for trust spreads." (Nakamoto, 2008, p. 1)*

Satoshi explains how the possibility of reversing transactions creates a greater need for trust, while also increasing the transaction costs. A third party institution, such as a bank, traditionally handles the aforementioned trust and applies the transaction costs. Of course, the uncertainties and transaction costs represented by this issue can be avoided using physical money in a face-to-face setting. Yet, in order to make digital transactions to overcome time and space limitations of transacting in cash, a trusted third party is required. This then represents the problem to which Satoshi proposes a solution, as such:

> *"What is needed is an electronic payment system based on cryptographic proof instead*
> *of trust, allowing any two willing parties to transact directly with each other without the*

23

need for a trusted third party. Transactions that computationally impractical to reserve would protect sellers from fraud and routine escrow mechanisms could easily be implemented to protect buyers. In this paper we propose a solution to the double-spending problem using a peer-to-peer distributed timestamp server to generate computation proof of the chronological order of transactions." (ibid)

The 'double-spending' problem has so far defined the failure of any conception of virtual or digital currency, regardless if it was developed and used in a closed environment, decentralized or centralized. The double-spending problem arises, whenever it is possible to spend the same digital token twice, which simply means duplicating the code. To combat this problem, the aforementioned trusted third party is usually employed to verify whether or not a single token of currency has already been used in any given transaction situation. The solution Satoshi proposes relies on a concept known as 'distributed computing', which is a system that employs components on networked computers in order to achieve a common computational goal. One such model of distributed (decentralized) computing is known as 'peer-to-peer', which is the model Satoshi proposes to deploy in order to circumvent the '(centralized) third party paradigm' solution to the double-spending problem. Further, the decentralized and encrypted nature of the distributed computing model also allows for privacy regarding the users' identities in the transaction situation. While the transactions themselves become public knowledge in the distributed network, the identities of sender and receiver are anonymous, according to Nakamoto (2008, p. 6).

Summary

In examining the original bitcoin white paper, it becomes unclear if the entity Satoshi realizes the paradigm shifting disruption, the innovative thinking of this idea may represent; In effect, trust in a third party, man-controlled centralized institution or organization, is replaced by a network of unbiased, decentralized networked computers. It could also be that Nakamoto did in fact foresee the impact this idea might have, and therefore chose to operate anonymously. While the idea begs the questions whether or not machines can be trusted, it does nearly eliminate transaction costs and enable near immediate worldwide transaction of value, circumventing financial, religious, cultural, and informational gatekeepers. To the author, it appears clear that this is the innovation of the Bitcoin protocol and the currency is information. As such, the protocol (or generally the concept) can be universally applied to transmit or store any type of digital information. A discussion as to why the protocol did initially conceptualize as a currency, when it could and is being developed for a number of other purposes, is beyond the scope of this text, but is worth noting.

2.3 The technology

The aim of this section is an attempt to discuss and isolate the constituents of what this text thus far have referred to as the Bitcoin protocol in order to shed light on the technical bits. This should provide an overview of the technologies involved and concepts used, yet keep the technological details to a minimum. The role of peer-to-peer technology will be further elucidated, while the blockchain, Bitcoin wallets, privacy and anonymity, will be explained.

Peer-to-peer

Peer-to-peer technology is hardly a novel invention, however, it bears mentioning that this technology is what enables the Bitcoin protocol to be decentralized. It stands in stark contrast to the client-server model, which is centralized. Instead of transferring data between a server and user (referred to as a node in the network), the data is transferred directly between users, removing the need for a central server (Bandara & Jayasumana, 2013). In the Bitcoin distributed network, these nodes consists of individual users, which donate computing power to keep the ledger updated. These individual user-run servers are referred to as 'miners', and can be run by any individual in the network with an internet connection. Every node in the network keeps a copy of the ledger, thus creating a very resilient system, which cannot be attacked from any one point.

Blockchain

The blockchain, commonly referred to as the Bitcoin ledger, is the public distributed ledger, which records Bitcoin transactions. It is being maintained by the computing power put forth by the miners. Without going too far into technical detail, this is achieved by adding blocks of accepted transaction data to the block chain ("block chain", 2015). Essentially the peer-to-peer network of miners work as payment processors, verifying and validating all transactions. In exchange for this computing power, these nodes are rewarded (or paid) in Bitcoin, hence the analogy of 'mining'. As of now, according to blockchain.info (2015), the Bitcoin network is performing upwards four hundred quadrillion hash computations per second, referred to as the hash rate ("stats").

Bitcoin mining

Despite being of little relevance to this thesis, the media-hyped concept of mining bitcoins warrants some explanation. In addition, this mining has an important secondary function in the system, which ties into a predefined inflation of the currency. As mentioned above, the miners, or nodes in the network, are paid in Bitcoin in exchange for computational power from the optional transactions fees. However, bitcoin is predetermined to inflate the economic system autonomously, which means coins will slowly be released into the system in a predictable manner, as opposed to being created from the birth of the system (or as needed by a central authority). And so, until the total predetermined amount of 21,000,000 bitcoins are in circulation, by year 2140, these new coins are being distributed between the nodes, according to their individual computational effort ("Controlled supply", 2015). By distributing new coins into the system in this manner, all nodes have an incentive to continue the mining process. Further, wealth from the system is being

distributed directly to the individual backers of the system, providing a strong incentive to keep the system running.

A common critique of this closed system, which does not replace bitcoins that become inaccessible[2], is that eventually the fixed supply will run out, unaware that bitcoins are effectively infinitely divisible. Although currently only to eights decimals ("Controlled supply", 2015). In addition, the digital nature of Bitcoin is subject to an iterative developmental process. Although Bitcoin is a prototype with flaws and issues, the digital nature of it allows for backward-compatible improvements to itself, which makes mass discarding and migration to other crypto currencies impractical.

Wallets

Bitcoin wallets are commonly referred to as being digital wallets used to hold and store bitcoins. This analogy, however, does a disservice to explain their role in the system. Due to the nature of the block chain, bitcoins only actually exist in the block chain. For this reason, it has been suggested that a better way to understand the wallet analogy, is to refer to it as a container, which stores the user's digital credentials for the bitcoins (Villasenor, 2014). The Bitcoin protocol utilizes a class of cryptographic algorithms called public-key cryptography, which generates two cryptographic keys, a private and public ("Private key", 2015). In the above analogy, the private key serves as owner ship credentials, which is stored in the wallet, while the public key acts as an account number. Thus the wallet is actually a container that holds keys to publicly held accounts.

In the context of this thesis, it is appropriate to discuss the media diversity of these wallets. Currently, bitcoin.org lists 16 trusted wallets divided into four types, which roughly can be differentiated as representative of media technologies. The first two share many similarities, mobile and desktop, which for this purpose can be considered as media platforms. The third type is referred to as 'hardware', and is represented by dedicated hardware to send online, or store bitcoins offline. Offline storage is often referred to as 'cold storage' and is the safest method of storage. The fourth medium of storage are online web wallets. This method is considered the least secure means of storage due to it being held by a third party, online service, which of course negates some of the advantages of Bitcoin. In particular, privacy and anonymity.

All software involved in these technologies, both wallets for ordinary users and miner clients, are publicly available and mostly developed in open-source environments. However, despite the intangible nature of Bitcoin, wallets have materialized in rather tangible forms, yet retaining its semiotic, digital nature. As such, many permutations of coins with imprinted keys can be found.

---

[2] This can happen in a situation where a user loses a private key and also in more technical instances.

Anonymity

It bears mentioning that although users are anonymous, the public nature of the block chain means that individuals or companies can be linked to conspicuous transactions that stands out, by investigative means. By involving third parties, such as currency exchanges and online wallet services, it becomes possible to gauge the identity of transactions taken place (Simonite, 2013). Often times these services require identity information, which can be used to link users to specific Bitcoin addresses. While not a part of the inherently anonymous and decentralized Bitcoin network, these centralized third party actors ironically play a crucial and indispensable role in the economic ecology around Bitcoin by allowing liquidity between fiat currencies and Bitcoin. Thus, a more correct term to describe the anonymity of the system would be pseudo anonymity.

Summary

In short, Bitcoin is a decentralized system, which acts both as a transaction system and a currency. All information resides on miner clients, which sustain the block chain (the publicly held ledger). By design, the public ledger forgoes a central authority to distribute or verify ownership of coins. Consequently all the processes related to these activities are handled by the protocol, making Bitcoin's primary innovation its ability to perform these actions without a centralized authority. Effectively, trust is displaced from a central man-controlled authority to a decentralized system of computers. The consequence of this is a system with no central point of authority, which makes it robust and highly efficient, allowing for near zero transaction costs.

Users in and of the system have pseudo anonymity, meaning they are only as anonymous as the keys they use. Most of the criticisms and uncertainties around the Bitcoin phenomenon appears to pertain to the latter, the currency. The former, the block chain, on the other hand, is the prototypical focus of many innovative permutations, beyond the realm of economics. Bitcoin, in a broad sense, consists of the protocol, which is open-source developed, globally distributed, peer-to-peer network. The state of the system is continuously encoded into a distributed data structure, commonly referred to as the blockchain.

In a historical context, Bitcoin represents a prototype for the first technology that allows for proof of ownership of digital assets without trusted third parties. This innovation enables peer to peer transactions of information between anyone, anywhere. As such, whereas the content of Bitcoin, or the blockchain, is a currency, these tokens can be made to represent any imaginable piece of information. Instead of relying on intermediary sources, information can be stored directly in the distributed ledger and accessed from this point, circumventing gatekeepers and free of manipulation, or contextually misleading information. The many possible implications of Bitcoin, and applications of blockchain technology in general, defies summary. The goal of this text is merely an attempt at understanding the nature of the Bitcoin medium, the space around it and how the Bitcoin in a holistic manner impacts upon society.

2.4 Bitcoin research

The previous section focused on Bitcoin in the context of the white paper, briefly discussing the concept and the dependent technologies, development environment, pseudo anonymity and the like. This chapter will expand upon the knowledge gained from the white paper, by introducing a number of Bitcoin focused research papers and articles. Research papers are chosen based on their relevance to the scope and the subject matter of these studies will be discussed in a thematic manner to avoid unnecessary redundancy. The scope dictates that the research materials take a somewhat holistic approach, which appears to be a fairly rare undertaking for good reason, as most papers focus on specific topics native to their field of expertise. However, the author has been able to extrapolate valuable information from such material. Finally, focus on papers pertaining to the nature of the medium has been of particular interest, shedding light on what is considered important qualities and features.

Bitcoin and disruption

The sentiment of this thesis is that research on Bitcoin as a whole remains scarce. However, numerous expert and educational institutions have published literature, testifying to the innovative and disruptive nature of Bitcoin. Often times, these attempt to dispel the media coverage misinformation about Bitcoin. Wan and Hoblitzell (2014) of Deloitte University points out that this misinformation is unfortunate as this shifts attention away from: "[…] its potential long-term significance as a disruptive new money technology" (p. 2). However, the disruptive potential does not end with financial institutions, as a disruptive new money technology.

The authors note that blockchain technology can be applied to the industry of transfer of property. Current Bitcoin technology could be qualified in a manner, which makes for instance 0.00001 bitcoin denote any real-world asset imaginable (Wan & Hoblitzell, 2014, 8-10). In effect, this means that brokers, lawyers or notaries to sign off on the transfer might be subject to the same disruption as financial institutions. As is any type of execution of contracts, identity management and so on. In a larger, more general sense, any digitized industry which handles information through a centralized intermediary might be subject of disruption. The medium that is Bitcoin, driven primarily through the innovation of the blockchain technology, is being refashioned to create value in other areas. As suggested in the review of the white paper and Bitcoin technologies, 0.00001 of a Bitcoin might be simply considered an information carrying token. As such, it might be made to hold other types of information than currency.

Because of this disruptive potential to a magnitude of centralized and government held areas, regulation of Bitcoin is the subject of much discussion. According to the Böhme et al. (2014), the vision of Bitcoin is broadly in tension with regulation and government control. The users of Bitcoin often describe themselves as libertarians, which denotes distrusting government regulation and monetary policies. As such, Bitcoin early adopters to a large extend consider themselves cyber-libertarians (p. 15). Regulation and the development of disruptive technologies by cyber-libertarians is closely related as one enforces the other. Böhme et al.

(2014) (in addition to a large number of other authors) make an important note in regard to this environment, as they refer to it as an ecosystem. Similarly, Krohn-Grimberghe and Sorge (2013) of University of Paderborn argue that it is indeed an immature ecosystem, pointing to the numerous incidents of theft and hacking events within said ecosystem. A symptom that the ecosystem is both evolving and changing rapidly, they argue.

Bitcoin is a system around which an ecosystem is continually evolving. The disruptive ideas that are derived from Bitcoin exists in a space, which also can be described as an ecosystem. These include the prior mentioned instances directly related to Bitcoin, such as currency exchanges, online wallets and similar services. However, refashioning of Bitcoin technology, such as described by Wan and Honiltzell (2014), also exist in an ecosystem. Some of these might co-exist with Bitcoin in the same space, others might exist in their own independent space, yet hold tight cultural relations to Bitcoin, and also in some cases compete with the Bitcoin ecosystem. For instance, other crypto currencies might be understood as competing with Bitcoin, in addition to the conventional money types (primarily state-regulated fiat currency).

The quality of Bitcoin (through the open source development space), that it is readily available to become refashioned into other uses, is regarded within this thesis as part of the phenomenon. Much has been said about the main features of Bitcoin, its current and future uses. While these papers and articles often times creates a thorough description of the system that is Bitcoin, in addition to the entities existing in the same space as Bitcoin, a thorough description of the space itself, along with the relations between the entities remains absent. To summarize, Bitcoin has an evolving and immature ecosystem around it due to its openness and easy adaptability into other disruptive means, which are driven largely by libertarian culture. The mentioned authors consensually refer to the Bitcoin space as an ecosystem, implying these artefacts indeed are interconnected and are, in the scope of this text, part of the phenomenon, which is being investigated.

Politics and trust of Bitcoin
The often misunderstood notion of who owns Bitcoin and what incentivised its creation has been addressed by numerous authors for good reason. In the author's experience, these questions appear to be a main obstacle in initially understanding and trusting Bitcoin. Rightfully so, as it may represent a shifting in money-paradigm. Without a central authority, no ownership can be established, which also implies that no individual or governing entity might directly financially benefit from its creation. Exactly because Bitcoin cannot be directly monetized by a central authority, it becomes important to understand why it was created. M. Jansen (2013) addresses these questions in the *International Journal of Community Currency Research*.

In the code of the genesis block, the first block of bitcoin transaction information in the blockchain, Nakamoto included the text: "The times 03/jan/2009 Chancellor on the brink of second bailout for banks". According to Jansen (2013), this was intended as a digital timestamp to prove that the block was created on or after this

date, in addition to a very obvious hint at the instability caused by the contemporary banking practice (p. 10). The solution to this situation, of course, is the very technology, signified by the block the text was imprinted on. Jansen adds that around the same time as the inception of the protocol, crisis struck the contemporary banking system in the USA, quickly escalating into a global financial crisis. Subsequently, many banks and other financial institutions were lend money by governments worldwide in an attempt to restore trust and prevent further catastrophic events (p. 9). This time of financial unrest, combined with the digital timestamp, appears to provide compelling incentive to create the protocol as an alternative to conventional financial institutions.

According to Jansen (2013), Nakamoto believes that the problem with conventional currency is the trust that is required for it to work. Banks must be trusted to hold money and transfer it electronically, however they lend it out in waves of credit bubbles (p. 10). While this enterprise is not equipped to or aimed towards discussing such matters, the issue of trust is an inherent necessity in all mediums, regardless of the content. For the decentralized system to work, trust is instead generated among the nodes in the network, which need to reach consensus. In essence, this is a political system that follows the rule that: "proof-of-work is essentially one-CPU-one-Vote" (Nakamoto, 2008, p. 3). In a manner of speaking, the governing system of Bitcoin can be understood as a decentralized, democratic system. Trust is not removed by using the Bitcoin protocol over conventional institutions, it is simply transferred to the network of nodes, or rather the protocol, which the nodes mutually agreed upon.

The mutually agreed upon protocol that governs Bitcoin is also derived by democratic means due to the system's decentralized nature and its open-source development environment. In short, trust is placed onto the protocol, which is a open source -community derived artefact. C. M. Kelty (2008), associate professor of University of California, Los Angeles, with a focus on cultural significance of information technology, expands on the phenomenon. The protocol works on the basis of the trust that the open source community members place onto their collective ability to review, evaluate and reach consensus as a group regarding changes to the code. Moreover, unique to Bitcoin's decentralized nature, the nodes cast their vote every second they operate a certain version of the protocol. Bitcoin will ultimately be what 51% of the nodes in the network agree upon.

In essence, Bitcoin might be perceived as an attempt by Nakamoto to create an alternative, open community derived type of trust in a medium. Open community derived trust in development of applications and systems is obviously not a new phenomenon, but Bitcoin includes an additional, democratic voting system by the nodes.

Bitcoin derivatives and ecosystem
Considering the numerous artefacts existing seemingly in the Bitcoin space, such as alternative Bitcoin derivative currencies or similar Bitcoin adapted technologies, it becomes exceedingly hard to understand,

which of these directly relates to the Bitcoin ecosystem and which operates outside of it. A macro perspective, describing the relations between these and the scope in which they exist, is necessary. Security and distributed systems expert, and recent Bitcoin consultant to the senate of Australia and Canada, Andreas Antonopoulos argues for a holistic approach to understanding Bitcoin as a culmination of several technologies. Antonopoulos (2013) writes in the publisher O'REILLY web magazine:

"Bitcoin is a combination of several innovations, arranged in a novel way: a peer-to-peer network, a proof-of-work algorithm, a distributed timestamped accounting ledger and an elliptic-curve cryptography and key infrastructure. Each of these parts is novel on its own, but the combination and specific arrangement was revolutionary for its time and is beginning to show up in more innovations outside bitcoin itself." (p. 1)

Antonopoulos argues that not a single technology, rather a novel combination of new technologies creates the basis of Bitcoin. In addition, these four mentioned technologies are by themselves being refashioned and according to Antonopoulos (2013) these appear to occupy roughly the same space as Bitcoin: "There's an ecosystem of innovation boiling around the bitcoin proof-of-concept implementation, in the form of alt-coins, meta-coins and blockchain-riders." (ibid). To understand which of these innovations exist within the same space as Bitcoin, thus might be considered part of the Bitcoin ecosystem, Antonopoulos (2013) offers a taxonomy of these Bitcoin derived innovations:

- Alt-coin as a term describes a crypto currency that shares the core structure of Bitcoin, but have slightly different properties, making it different and improving upon a certain aspect of the currency. It then enters in competition with Bitcoin and other crypto currencies for adoption with its own blockchain and currency implementation. At the time of publishing, 2013, hundreds of such alt-coins exist.
- Meta-coins are implementations onto the Bitcoin currency. This entails using the Bitcoin blockchain to encode metadata within novel transaction semantics, also referred to by Antonopoulos as blockchain riders. These can be considered adapted uses of the Bitcoin blockchain, similar to the, by Wan and Hoblitzell (2014) suggested, other denotations of the Bitcoin tokens.
- Para-chain is a term designated to implementations of the distributed blockchain for other, non-currency purposes. Much like meta-coins, but using a separate, adapted blockchain.

It is easy to see how alt-coins and meta-coins exist in the same space and enter into rivalry with Bitcoin, while sharing obvious cultural ties. Para-chains, however, might enter and disrupt other information oriented ecosystems, outside that of Bitcoin. Following this, alt-coins and meta-coins might be considered occupants of the Bitcoin space, or a part of the ecosystem around Bitcoin. According to Antonopoulos (2013), the suggested taxonomy of rapidly derived Bitcoin technologies describe an ecosystem, which is subject to evolution-like fitness function, resulting in: "[…] splintering, re-convergence, and birth and death of

currencies at a frantic pace." (p. 1). This notion aligns well with the numerous examples of theft and hacking in a fast pace evolving ecosystem, observed by Krohn-Grimberghe and Sorge (2013).

As such, the authors gathers that Bitcoin is a culmination of a set of novel technologies, which through its openness has created a hotbed of evolution-like innovation that are occupying the same space as Bitcoin in most cases.

The inseparability of Bitcoin and the currency
In discussing the nature of the Bitcoin medium, or rather the constituents of the protocol, it becomes hard to determine exactly how these are interconnected. Or even, if they should be analysed in isolation or in a segmented manner. In the context of this thesis, of defining Bitcoin as a medium, it becomes an imperative to understand these interactions. At O'REILLY Radar summit; *Bitcoin and the Blockchain*, January 27, 2015, Antonopoulos (2015) argued that these are inseparable. The summit was a response to a growing discussion around separating the blockchain from the currency, and therefore lends itself well to approaching a delimitation towards defining the Bitcoin medium in present text.

It is important to note that in this discussion, the blockchain, or the ledger, is considered the network. Without the network, the peer-to-peer distributed database (blockchain) would not be. So the discussion revolves around the inseparability of the currency and the network. According to Antonopoulos (2015) the notion of Bitcoin as a currency, as a network or as a technology becomes trivial as it is all of the above. The currency and the network becomes inseparable because the consensus network bases its value on the currency. In turn, the currency does not work without the network. This interdependency might be considered as a whole, the Bitcoin technology, or the Bitcoin protocol, or within the context of this text, the Bitcoin medium. As such, these designations all refer to the same artefact. Again, repeating the notion that Bitcoin is both a medium of exchange and the specialized currency within that medium. One cannot operate without the other. However, the currency can be made to denote any type of information as previously discussed, making it more of a token system or simply a unit of information within a medium.

In the same summit, Antonopoulos (2015) makes another important point, which ties into the nature of Bitcoin innovation and how the ecosystem around Bitcoin evolves due to this. Here, Bitcoin is referred to as a dumb system, similar to the internet:

- Andreas exemplifies, the internet does not know or discriminate the data it moves. It simply just moves it from A to B. Similarly, it does not know or care if the interfacing technology on the end of it is a smartphone or a TV. In the same manner, Bitcoin does not discriminate in matters of amount (of currency or information) or users involved.

- Just as the internet, innovation efforts is pushed to the edge, driven solely by the user. It is innovation without permission, without central approval and without broad network upgrading. Moreover, Bitcoin is open-source and open standard.

This basically means that anyone can design and create innovation at the edge, which interfaces and interacts with the network. Because Bitcoin is simple at its core, it creates opportunity for and supports innovation at what Antonopoulos refers to as the edge. This might also be considered the front-end of the Bitcoin medium, while the system itself, the protocol, the back-end. In turn, these Bitcoin depended front-end artefacts obviously become a part of the Bitcoin ecosystem as they both interact with and rely on the protocol. These artefacts consist of all the applications and services, miners and wallets, which users employ to interact with Bitcoin.

Summary

Authors seem to reach a consensus in using the 'ecosystem' metaphor to describe the space around Bitcoin. Yet this space, or the usage of the metaphor, appears in no way defined or structured in the literature. However, the ecosystem is described as immature, which might be attributed to its rapid and evolution-like development. In light of this, the ecosystem is also described as being highly competitive as technologies and similar alt-coins are competing for user adoption in the same space.

These technologies are being developed by and in a libertarian, open source culture of individuals. Following the openness of this development environment, Bitcoin both is developed and run in a democratic manner, as all nodes cast a vote with every hash they perform, by means of the version of the distributed software being run. The issue of trust is an inherent necessity in all mediums, and Bitcoin appears to create this by having two layers of egalitarian development measures. Finally, it is important to note the inseparability of the medium and its specialized content, which can be interfaced and interacted with through a range of front-end, or 'edge', applications or services.

2.5 Chapter Conclusion

The white paper, the concepts and novel combination of technologies pertaining to this, appears to create the basis for what the author considers the Bitcoin phenomenon and through this chapter, these have been brought into perspective. Based on the Bitcoin-focused sources and literature review, a greater understanding of the nature of the medium has been gained. The decentralized system and the subsequent open discourse, democratic manner in which it is being run and developed, is both novel and disruptive. The openness of this development space enables the evolvement of a rapid and frantic paced ecosystem of both competing Bitcoin-derived technologies, which competes in the same space for adoption, and 'at the edge' innovation of Bitcoin-based applications. Many authors understand this space as an ecosystem, without delimiting or defining this from any given perspective. Additionally, Antonopoulos argues that the protocol cannot be separated from the currency. That is, Bitcoin as a medium cannot be separated from its content, the currency. However, this currency might simply be considered tokens and subject of reinterpretation as needed.

A greater understanding of the Bitcoin space and how it might be understood as an ecosystem, while also approaching important aspects of the nature of Bitcoin, has been gained through this chapter. These two, Bitcoin as a medium, and the space in which it is being developed, do not appear easily distinguishable, which seems to verify the sentiment of this text that Bitcoin must be understood in a holistic manner in order to understand the Bitcoin phenomenon.

Concluding this chapter, answering the research question, what is Bitcoin, empathy has been put on the decentralized nature in which it operates and the open source, egalitarian environment it is being developed, as these appear to be core concepts of the phenomenon. Also, the interdependency and interrelation of the constituents of both the technical concepts as the referred ecosystem around the Bitcoin protocol, or the medium, appears to be an important descriptor of the artefact. The pace at which this ecosystem evolves, promoting both new uses and developments within said ecosystem and entirely separate and new ecosystems (although with strong cultural ties to Bitcoin), is also considered important details in concluding this chapter.

CHAPTER III – BITCOIN IN MEDIA PERSPECTIVES

3.1 Chapter Introduction

The prior chapter established an understanding of the Bitcoin technology, the nature of and the space in which it exists and is being continually developed. However, notions on and perspectives of the nature of media technology from both historical and contemporary perspectives are absent. These will be discussed in the context of Bitcoin in this chapter.

The purpose of this chapter is to add media specific perspectives onto the phenomenon with the goal of gaining a greater understanding of the historical, and to some extend philosophical, context in which Bitcoin exists as a medium. Additionally, the goal of this chapter is to provide a necessary conceptual clarification of such central concepts as the nature of media and money, historically and current, to approach the task of making assertions about the impact, nature and meaning of Bitcoin. The current space around Bitcoin will, to some degree, be subject of reflection, as will the information learned from the prior chapter. As such, this chapter seeks to address the question is; how might Bitcoin be viewed in a basic media-historical perspective?

3.2 Media perspectives

The challenge in discussing Bitcoin in the context of a wider media horizon undertaken in a thematic manner is to avoid redundancy. As such, this section is signified by thematic paragraphs, which are syntheses of overlapping perspectives, or stand-alone perspectives that are considered valuable by the author. These perspectives are primarily based on the work by Marshall McLuhan and Irving Fang. Contemporary scholars are included as needed.

The seminal work of Canadian media theorist and philosopher, *Understanding Media: The extensions of man* (1964), is by critical editor Terrance Gordon described as central piece of McLuhan's work (p. xiii). In light of this and the impact this work has had on media theory, the theories, based on the aforementioned work, presented by McLuhan bears significant weight in understanding the phenomenon of Bitcoin.

In his work, *A History of Mass Communication* (1997), contemporary author Irving Fang identified six historical information revolutions. The goal of this endeavour was to discover common themes and impacts of these. Although categorized, the events and media technologies that are seen as constituting these periods are overlapping and thus defy systematic categorization. While not explicitly commenting on it, it seems Fang employs a rather liberal use of the word technology, not unlike that of McLuhan.

To understand the theory of McLuhan (1964), it is key to understand the defining premise upon which it is built. Technology and media become synonymous terms, as both concepts are utilized to describe tools by which extensions of social, physical, psychological or intellectual abilities can be achieved (p. 4, 90). In short, the McLuhanite definition of a medium is simply that which enriches and expands upon the human sensorium, mind or body. As such, it is very versatile and can be interpreted rather liberal. From this versatile definition of media, all the subsequent McLuhanite ideas flow. To a large extend it appears as if the concepts of technology and media overlap, and it appears useful to adopt these. Although used interchangeable, the author will not discriminate between terms: technology, communication tools and media, as they all refer to the same type of artefacts in this context.

Media impact

> *"... in operational and practical fact, the medium is the message. This is merely to say*
> *that the personal and social consequences of any medium, that is, of any extension of*
> *ourselves-result from the new scale that is introduced into our affairs by each extension*
> *of ourselves, or by any new technology [...]" (McLuhan, 1964, p. 49)*

The McLuhanite idea of media having a profound effect on the individual and culture resonates with optics of this thesis. The social and personal consequences of interacting with a medium is the real impact of a new or developing technology, which is the premise upon which this text launches its enquiry into the

phenomenon at large. Fang (1997) agrees with McLuhan's perspective that "the medium is the message", in that the content may not have as much of an impact on humans as they way lives are shaped around the mediating technology (p. xx). As such, the effects of content are quite independent of the effects of using the medium that is carrying the content, and the latter is seen as being of greater importance. In addition, Fang notes that when enough people adopt a new means of communication, which change the way trivial interactions are carried out, society itself is altered (p. xxi). For example, the fact that computers have developed into ever smaller artefacts, have enabled users to become more productive while traveling. Smaller, mobile computers allow users to work while using public transportation. As such, instead of interacting in other ways, reading a book (unrelated to work), napping or chatting, the technology changed this pattern of behaviour into a more productive one. The evolution of the computer from a purely stationary machine to a mobile device, changed the behaviour of its creators, man. As such, not only the inception of a new technology have an impact, the subsequent development of a given technology might prove to change the scale of impact it has. Fang sums up this relationship by: "We changed the media and then the media changed us" (p. xxi). This might also be the case with Bitcoin. It conceptualized as a very simple system for transferring a currency between users via the internet. Because of the open community innovation at the 'edge' of Bitcoin, discussed in prior chapter (the inseparability of Bitcoin and the currency), the impact Bitcoin has over time, is controlled by how it is being developed and shaped at the edge, where users interface and interact with the Bitcoin protocol.

In more general and condensed manner, McLuhan (1964) articulates the relationship between man and technology as such: "[...] the "message" of any medium or technology is the change of scale or pace or pattern that it introduces into human affairs." (p. 49). The message of Bitcoin becomes a matter of imagination and guess work, as it is still considered very early in experimental development. From a macro perspective, understanding the Bitcoin phenomenon as a proof of concept prototypical technology, the impact of Bitcoin becomes impossible to foresee. In this sense, the message of Bitcoin is proof of concept of the blockchain technology, which may usher in a revolution of Bitcoin technology derivatives. Of course, it would be parochial not to acknowledge the impact it is already having on particularly established financial institutions and how it might be benefitting un-banked populations. Attempts at regulating and censoring of the medium have already occurred globally, which have led to a variety of differing institutionalized definitions with accompanying frameworks for understanding and regulating it, while a general social impact definition of the medium is absent. The fact that state institutions acknowledge the impact Bitcoin has and might have is indicative of its disruptive potential, which was described in the previous chapter.

Remediation

In regards to the impact of new technologies to a larger extend becoming transparent to the user and ubiquitously embedded into all aspects of life, Fang (1997) notes that it " [...] has the unintended effect of leading us to overlook their individual and collective impact on society" (p. xxiii). In new media theory, this phenomenon is referred to as immediacy and describes how new technologies are attempting to increase

the efficiency by which the mediation of information becomes invisible, placing the user in direct contact with the content, erasing the signs of mediation (Bolter & Grusin, 2000, p. 81). Fang (1997) describes this development, as: "[...] we live in what is becoming a borderless world" (p. xxiii). If this statement was true at the end of the 20th century, it must be more so now. Bitcoin adds significantly to the legitimacy of this observation, as its decentralized nature allows it to transcend political and cultural borders, while simultaneously becoming more and more imbedded into society by means of ubiquitous computing, and thus promoting Fang's claim of a borderless world. Ubiquitous computing, a term coined by Mark Weiser (1999) in the 80'ties, describes the observation and ideal that ubiquitous computing, by means of continually increasing the miniaturization of embedded hardware, diffusing throughout human environments, becomes pervasive and invisible to society. As a digital artefact, Bitcoin too is subject to becoming more and more embedded into human physical environments.

On the opening page of *Understanding Media*, McLuhan (1964) claims that the content of every medium is always another medium, expressed as: "The content of writing is speech, just as the written word is the content of print, and print is the content of the telegraph" (p. 19). The perspective that the content of every medium is always another medium, an idea later termed remediation, is central to the McLuhanite framework in explaining the impact and development of media. In the seminal work by Bolter & Grusin *Remediation* (2000), the former author professor in School of Literature, Media, and Technology at the Georgia Institute of Technology and the latter director at the Center for 21st Century studies at the University of Wisconsin-Milwaukee, provides a contemporary definition on this, referred to as 'the double logic of remediation': "Our culture wants both to multiply its media and to erase all traces of mediation: ideally, it wants to erase its media in the very act of multiplying them." (p. 5). Two concepts are introduced within this definition, *immediacy* and *hypermediacy*, which makes up the 'double logic' of this theory. The former representing the ideal that the medium itself should disappear and leave the user in presence of what is being represented (p. 6), while the latter describing an ideal to multiply the signs and representations of mediation to attempt to reproduce the human sensorium (p. 34). According to Bolter & Grusin (2000), these two, seemingly contradictory logics, coexist and are mutually depended, in the continuum they refer to as the double logic of remediation. Remediation in this text is seen as being an inherent and defining characteristic of digital media, which dictates that it is constantly attempting to remediate its predecessors. In digital media, such phenomena as simulations and virtual reality are obvious examples of remediation (the double logic), which seeks to represent the world as accurately as possible, while attempting to eliminate signs of mediation in the act. In a sense, Bitcoin is the virtual, simulated counterpart to cash, and is often referred to as such: digital cash.

In light of this, the author finds it useful to consider media definition derived from the theory of the double articulation of media, by Bolter and Grusin (2000):

> *"[...] a medium is that which remediates. It is that which appropriates the techniques,*
> *forms, and social significance of other media and attempts to rival or refashion them in*

the name of the real. A medium in our culture can never operate in isolation, because it
must enter into relationships of respect and rivalry with other media" (p. 65)

As such, in the light of this definition, the assumption that Bitcoin indeed is a medium becomes more evident, as it remediates two clearly distinct artefacts. Money, as the content of the medium, and the institution structures or systems, which mediates this means of exchange. Both are being mediated in the same technology, because Bitcoin is both a system for transferring, and the currency which is being transferred. As such, Bitcoin can be said to operate and rival conventional financial institutions and established currencies by both remediating form, function and content. The dual logics of remediation dictate that Bitcoin must strive to impose increased hypermediacy and immediacy over its predecessors in order to rival and remediate "in the name of the real". Of course, it goes well beyond the scope of this text to comment on the efficacy of this remediation or the degree to which it rivals its predecessors. However, it is clear that Bitcoin does hold strong cultural ties to these other industries and technologies and a level of rivalry is going on.

Fang (1997) provides an example of remediation, which is very easily reflected onto Bitcoin. Fang describes how the advent of the internet, in conjunction with the e-mail protocol, completely redefined how mail information was sent, displacing the post office as the sole and centralized entity of information transportation (p. 225). The internet obviously made such physical transportation of information obsolete. Of course, post offices still exists today, but they transmit a mere fraction of the information send by the decentralized e-mail protocol. It is not unreasonable to assume the same development will apply to financial institutions, such as banks, as the Bitcoin phenomenon (both the protocol and other emerging crypto currencies), offer significant advantages, not unlike that of the e-mail protocol over post offices.

Besides having obvious cultural ties to money and financial institutions, and thus rivalling these for adoption, remediation of Bitcoin is referred to by Antonopoulos (2013) as evolution-like fitness, due to the open source, development environment. This remediation, however, is not only limited to remediation of the entire protocol for other, or similar, purposes, similar refashioning is happening at the edge of the protocol, which becomes a significant part of the Bitcoin ecosystem and thus the phenomenon.

Technology determinism
Fang (1997) uses the term *information revolution* in a relatively wide sense, as it describes trends in communication media. These trends are constituted by a drive for social change and by the invention of new technologies: "The media both aid and are aided by whatever has shaken the existing order, for those who seek change will reach out to grasp whatever means become available to gain support for their opinions." (p. xvi). Information revolutions then, becomes a convergence between a social drive for change and the advent of new media technologies. This perspective demands a discussion into the determining nature of this relationship. Fang describes the connection between this drive for social change and the invention of new media technologies as an interwoven cause and effect relationship (p. xvi). While admittedly vaguely touched

upon, throughout his work Fang appears to take a rather neutral deterministic position. He sees social change as a result of a continuum in which human drive for change is developing new technologies and new technologies create opportunities for human change. This perspective is not unlike that of McLuhan (1964), who believes that media technologies continuously create new human environments and that these environments are dynamically evolving with our culture (p. 21). Despite this, it is important to note that the McLuhanite theses are considered to be grounded in technological determinism according to Lister et al. (2009, p. 329).

Technology determinism is an important issue to address as it relates to whether or not - and to what extend - technology conditions social change and creates the pattern of social organization. In general it explains the relationship between technology and society as a cause and effect relationship. This perspective is hard to depart from in the context of this thesis, as Bitcoin is seen as a disruptive technology with social implications. According to Yu & Hang (2009), a disruptive innovation is commonly and simplified referred to as a an innovation that creates a new market and market value, while disrupting existing ones, eventually displacing an earlier technology. The mechanism behind this disruption and replacing (by displacing) existing technologies reflects the double logic of remediation and by extension the employed definition of media priorly discussed. However, the impact of this disruption onto the social scale and the structure of society is the concern of this text, and Bitcoin is believed to have such an impact. By virtue, it becomes impractical not to adhere to a technology deterministic stand.

However, technology determinism is not a one-sided theory and is subject to variability. One such variation is the function of causation, which seeks to explain what causes change by means of technological change. Out of three contemporary models of causation within technology determinism, McLuhan adhere to the non-linear school of thought when accounting for electric technology (or interactive digital media), according to Lister et al. (2009, p. 335). The contemporary sciences that are engaged with this mode of causality concern themselves with a concept inherent to this mode of causality, *emergence*. This concept describes how order arises from chaos and is applied across all sciences that concern themselves with natural and social phenomena. Lister et al. describes the implication of emergence as such:

> *"[...] something coherent and organized arises not from a single cause but from any*
> *number of factors that converge to form a 'looping' or feedback structure, giving rise to*
> *what is called a 'self-organizing' phenomenon" (p. 333)*

In relation to the phenomenon at large, such logic appears compelling to explain the cause and effect relationship of Bitcoin. Many aspects of Bitcoin seems to share this attribute of being self-organizing, seeing as Bitcoin manifested itself from an idea to an open source conceptualization, which appears to have created a culture of decentralized, blockchain-ideology driven technologies. In a manner of speaking, Bitcoin appears to have arisen out of chaotic ideas and development by many entities into an organized artefact, with a sustaining ecosystem around it. As such, the concept of emergence within the technology determinist

perspective provides a causative mode of cause and effect explanation, which appears a well-adapted mode of causation to view the phenomenon at large.

Information revolutions

Fang (1997) points to Tiananmen Square as an example of communication technology as a tool of political change (p. xxv). The pixelator allowed the user to transmit video footage via telephone lines, as the government had blocked satellite communication, thus circumventing government attempts at censoring communication. In recent history, consider how media technology played a significant role in the Arab Spring by enabling protesters to rally in demonstration and communicate with the outside world. In even more recent history, Chinese government failed at censoring the Hong Kong demonstrations in 2014. The demonstrators created a mesh-network of computer devices, which enabled internet connectivity throughout the network, circumventing government enforced disconnection and internet censorship. The commonalities between these examples being that communication technologies enable social change and reorganization of fundamental structures of society, reflecting the notion of technology determinism. The sentiment of this thesis is that the Bitcoin phenomenon too has the power to reorganize social structure and that this process is already happening, although in a more peaceful, inconspicuous manner.

According to Fang (1997), six information revolutions has occurred thus far of which the first is the writing revolution. This revolution is characterized by the invention and utilization of a common sign system, which represented the spoken language. The purpose of this medium was simply to record, store and transmit information, and it materialized as papyrus, clay tablets, etc. The sociol historical features from this era includes the formation of urban communities, such as Sumer and Tigris. The writing revolution is overlapped and followed by the printing revolution. Mass media*,* the third revolution, is signified by the development and usage of technology which makes it possible to transmit a message to a broad audience. In continuation of the improved technologies, which allowed the mass media revolution, the fourth revolution emerged, Entertainment*.* Fang defines this revolution as the development of technology for means of mass storage and distribution of entertainment. The fifth revolution, the tool shed home, literarily defines a media revolution by communication tools, which are situated in the home.

Replacing the tool shed home revolution, Fang (1997) dubs the period we are most familiar with 'the highway revolution'. This revolutions is signified by the advent of technologies which allow the gathering, production and distribution of large amounts of information, transcending limitations of time and space. Emerging in the middle of the 80'ties with the internet and microprocessors, this is the revolution that brought forth most of contemporary digital technologies. Communication in the period of the information highway is expanded primarily by the advent of interactive digital media and the internet, brought forth by computer technology. The consequence of this interactivity is that users gain more control of information, by enabling 'upstream' requests for 'downstream' data. Interactivity and the internet connects people who might forever remain

disembodied, as it makes distant connections across time and space possible (p. 190). The concept of interactivity will be further explored in the following chapter.

Until something definitively novel conceptualizes with corresponding social change, or drive for social change, it is impossible distinguish between information revolutions in Fang's media historical perspective. As such, Bitcoin might be considered either as a development within an ongoing information revolution paradigm, or it can be considered something entirely new, or emergent, ushering in its own set of changes upon society, or rather on the global society. These, by Fang, observed revolutions share a set of commonalities, which will be discussed in the context of Bitcoin later in this chapter, as an exercise in discussing the novelty and possible impact of Bitcoin, in addition to exploring the notion of Bitcoin as an information revolutionizing technology.

McLuhan's global village

Following the McLuhanite definition of media technology, any extension of ourselves, McLuhan (1964) defines the first medium by man as speech, by: "It is the extension of man in speech that enables the intellect to detach itself from the vastly wider reality. Without language human intelligence would have remained totally involved in the objects of its attention" (p. 79). Thus, the spoken language is by McLuhan considered the genesis medium, as it is the key development in the evolution of human consciousness and culture. All subsequent media or technology developments are based upon the medium of speech. Upon the emergence of what McLuhan (1964) refers to as electronic media, the level of significance of the extensions elevated:

> "Whereas all previous technology (save speech, itself) had, in effect, extended some part
> of our bodies, electricity may be said to have outered the central nervous system itself,
> including the brain" (p. 247)

As such, the advent of electronic media holds a special place in the development of media in the McLuhanite framework. Prior to this, the technologies revolved mostly around extending mechanical capabilities at the end of one's hand. A crude example would be a hammer as an extension of our hands to transmit force. However, this one-sided, mechanical effect of technologies on human affaires was ended with the advent of electric technology:

> "Rapidly, we approach the final phase of the extension of man—the technological
> simulation of consciousness, when the creative process of knowing will be collectively
> and corporately extended to the whole of human society, much as we have already
> extended our senses and nerves by the various media. " (p. 5)

Thus, McLuhan sees all extensions prior to the advent of electricity as physical outward extensions, while electronic technology extensions are instead an inward extension toward a shared consciousness. McLuhan termed this phenomenon 'the global village', a term he first coined in *The Gutenberg Galaxy: The Making of*

the Typographic Man (1962). Before technology developed, and especially digital media technology, people relied on verbal and non-verbal communication. Relationships were based on local and personal knowledge, hence the village metaphor. With new media technologies, this is happening again, except on a much larger, global scale. Hence 'global village'. The question and consideration, in this observation, is that in this new global village, a medium stands between every connection that is made, which perfectly exemplifies the importance in recognizing that "the medium is the message". In a sense, McLuhan uses the 'global village' metaphor to describe social decentralization by media technology. People become detached physically and connected globally today more than ever, primarily by means of the internet protocol, or collectively what Fang (1997) refers to as the technologies of the information highway revolution.

By means of interconnected interactive digital media, users are capable to connect worldwide, sharing information and digital media of all types, almost limitless and frictionless. It is unlikely that McLuhan could have foreseen just how right he was in this development. Contemporary media theory scholar Genosko (1999) credit McLuhan with having predicted the internet and its impact some 30 years prior to its conceptualization. However, while the global village ideal appears to be fully realized (although perhaps not exactly as McLuhan had predicted), a vital element of the village is only vaguely present. A multitude of instant, free and able tools exist to mediate any type and size of information. Yet, the mediation of monetary value by conventional digital tools is both inefficient and expensive. Intermediaries in the industry of transferring value both take significant fees and are very inefficient when compared to the industries focused on simply transferring non-monetary information. In addition, significant political and cultural based restrictions are imposed. Omitting a comparative analysis of these two industries, it is safe postulate the existence of significant asymmetry. Many aspects might be touched upon to explain this asymmetry in efficiency and openness, but one imperative in particular overshadows: the need for trust. By displacing the need for trust in a centralized man-controlled entity, Bitcoin's open and democratically-derived trust might complete the McLuhanite ideal of a global village.

From centralized to decentralized

The global village metaphor might also be described in a larger, societal sense. A theme shared by both Fang and McLuhan is the movement from centralized to decentralized society structures. As a refinement of the global village principal, McLuhan (1964) claimed that networked digital technology would eventually act as an 'extension of consciousness'. "Today, after more than a century of electric technology, we have extended our central nervous system in a global embrace, abolishing both space and time as far as our planet is concerned." (p. 5).

Fang (1997) observes that in totalitarian societies, where media is often oppressed, large families are the norm, while in democratic societies, in which media technologies are freely diffused into populations, the opposite holds true (p. 192). As such, people are being separated by technology in space, but united in communication by the same technology. Fang adds onto this observation: "The population movement from

the countryside into cities forced by the Industrial Age may yet be undone by the newest Information Age."
(p. 193). Referring to a de-urbanization, caused by the new media technologies. The need for transportation
as a means of being present in a communication or labour situation becomes less and less necessary. The
classic example of this being the ability to work as well as study, while traveling, or simply just from the
confines of home. Or rather, as Fang would have it, the tool shed home. The tools of communication are
readily available and connected regardless of where the user might be, as he or she lives in a global village
enabled by Weiser's ubiquitous computing.

McLuhan (1964) appears to differentiate between two types of media technologies, which introduced two
differing trends into human affairs:

> "The restructuring of human work and association was shaped by technique of
> fragmentation that is the essence of machine technology. The essence of automation
> technology is the opposite. It is integral and decentralist in depth, just as the machine
> was fragmentary, centralist and superficial in its patterning of human relationships" (p.
> 19).

As such, McLuhan (1964) differentiates between machine technology and automation technology. He
describes machine technology as centralist and fragmentary, while automation technology is decentralist
and integral. Fragmentation by machine technology, works by fragmenting a process and putting it into a
series or sequence. Electricity (automation technology) put an end to the sequencing by making events
instant. More importantly, centralization is a quality attributed to the industrial age, while decentralization
is a quality attributed to the information age, which is a common perspective shared by McLuhan and Fang.
A movement towards decentralization has been happening since the advent of electricity, or the information
age as Fang (1997) would have it. It is within this continuum and this consideration that Bitcoin is perceived
as a disruptive phenomenon, because it is, within this text, seen as radically enhancing this movement
towards decentralization.

Similarly, Lister et al. (2009) closely relates new media to a shift from modernity to postmodernity, signifying
fundamental change in cultural and economic structures. Intensifying processes of globalization, referred to
as a dissolving of boundaries pertaining to trade, nationality, culture, identities and belief (p. 10-11). By virtue
of the networked, open source and decentralized (and decentralizing) nature of Bitcoin, it is apparent how
these characteristics contribute to this fundamental shift of cultural and economic structures. In this respect,
Bitcoin can be seen as a remediating vehicle of globalization, as it by itself and by its derivative innovations
(as an effect its open sourced nature) appears to adopt and perpetuate these qualities. As such, the author
establishes a close relationship between decentralization and globalization, which is also seen more broadly
as a shift from modernity to postmodernity. This shift also entails a replacement in the west of the industrial
age by a media-driven, post-industrial, information age (p. 12). This signifies a shift from industrial produced
goods to service and information 'industries'. The perceived immateriality of Bitcoin (and the labour required

to mine Bitcoins – computing power) reflects this shift in labor, as the production and the nature of Bitcoin is immaterial in nature, at first glance.

In light of this perspective, this movement from centralization to decentralization can be understood as a megatrend in human affairs and technology appears to assume a vital, determining role in this. This reflects McLuhan's view of the mechanic nature of the industrial age and centralized society into how the electronic nature of the information age decentralizes society. From this perspective, Bitcoin might be seen as a component in the information age, as a symptom of an accelerating decentralization. Because Bitcoin can be understood as a technology without a central point of operation, or central physical dependence, Bitcoin might be referred to as a decentralized technology, while also being an engine of accelerated decentralization of society, globally, in the same manner as the internet, which furthers the McLuhanite ideal of a global village.

Discussion & Summary

Bitcoin, and thus its impact, will ultimately be what its open source community of users want it to be, empowered by Bitcoin as a highly, democratically developed artefact. It will ultimately become, what the majority of its nodes want it to be. According to Fang, this pattern of refashioning and repurposing (remediation) has been repeated in six information revolutions. "The message of the medium" is what its users seek to use it for at the edge. The scale of change and impact introduced into human affairs, will be reflected by this. In the view of McLuhan and Irving, media technology is distinguished and to some degree defined by the impact they have on their environments. A more pragmatic approach is to conclude that Bitcoin is defined as a medium because it remediates prior technologies, attempting to rival by appropriating form, function and social significance. In other words, Bitcoin is seen as a disruptive innovation with an evident social impact from a technology deterministic stance. As ubiquitous computing is becoming ever more prevalent, coupled with the open source development environment of Bitcoin, the double logic of remediation evolves the form and function of Bitcoin at a frantic speed, causing an immature and rapidly evolving ecosystem.

The information age sees a general decentralizing mega trend in human affairs, which Bitcoin through its qualities is seen to accelerate. Bitcoin is not only decentralized in its distributed infrastructure, it is also a vehicle of decentralization of society. The author understands McLuhan's concepts or ideal of the global village as a product of this decentralizing by use of media technologies and asserts that Bitcoin might further this ideal. As such, Bitcoin rivals and attempts to remediate conventional financial institutions and systems for the transfer of value in a world, which is becoming more and more decentralized.

3.3 A New Medium

Each information revolution is observed to share characteristics with the others. As such, Fang (1997) lists a number of common characteristics between what he understands as six distinct, yet interrelated media revolutions. He notes, however, that while all the revolutions approximate identifiable beginnings, none of them can truly be said to have ended. These characteristics will be reflected upon in light of the phenomenon at large to speculate the impact of Bitcoin, implying that it might serve as an information revolutionizing technology.

Fang (1997) observes that Information revolutions are characterized by more than one invention, such as papyrus and the phonetic alphabet, and also by having taken place in an environment of social or political unrest and drive for change. The invention of such communication tools contributed to and amplified the drive for change, entering into a symbiotic relationship of cause and effect. The social change caused by these revolutions induced some levelling of the given conditions for those participating in them (p. xviii). The revolutions are characterized by a combination of a social drive for change and the invention of new technologies, which result in social and political movement towards egalitarianism. As seen in the prior chapter, Bitcoin is the culmination and novel combination of several inventions, conceptualized in a time of social unrest as mistrust in the conventional financial institutions is expressed on the genesis block. By its democratic nature, Bitcoin enables movement towards egalitarianism, globally.

Lister et al. (2009) notes similar observations, as decentralization of established, centralized geopolitical orders is brought forth by new media technologies. On a large scale, facilitated by boundary-transgressing networks of communication by new media, lessening mechanisms of control and power structures (p. 11). Lister et al. describes the mechanisms behind this shifting, or displacement of power, that Fang (1997) observes through all revolutions, which is also currently happening with new media, in the revolution Fang refers to as the information highway. How Bitcoin, as a protocol for transferring monetary value, might accelerate this decentralization of centralized geopolitical orders is obvious, as Bitcoin does exactly what is by Lister et al. is described as driving this development: boundary-transgressing communication networking.

Fang (1997) notes how each revolution sees a widening of the availability of communication tools, which means more producers on a greater variety of subjects, reaching a larger audience. Simply put, the content broadens each revolution. This is turn increases what postmodernism identifies as *decentring and fragmentation* (p. xviii)*.* That is, a widening of the points of views, contexts, frames of reference, opinions and experiences. Decentralization happens not only on a geopolitical scale, as noted by Lister et al. (2009), but also on a personal level, affecting individual identities. Fang adds, these changes are accompanied by an increase in sharing of information and specialization of knowledge, which in turn also lead to an overloading of information, along with an increase in misinformation (ibid). Particularly in regards to Bitcoin, there appears to be created an enormous amount of misinformation, which in turn creates more perceived uncertainty in regards to the phenomenon in its entirety.

Fang (1997) observes that in each revolution, the result of communication tools being diffused into and adopted by populations is an increase in general complexity. In addition, the cost of the technology is likely to drop, while the efficiency of transmitting data become greater (p. xviii). The advent of new literacies is a result of new communication technologies, as they have arisen in order to accommodate these. With each new language, from the ancient phonetic alphabet to binary codes of today, comes a new class of experts in that particular language (p. xix). While still in its experimental infancy, the Bitcoin phenomenon has its own language and experts, often referred to as *Blockchain engineering*. This designation refers to the new literacy of blockchain technology experts.

A significant characteristic of the information revolutions is that they have all been met with resistance. As such, changes in communication means opposition by those individuals or intuitions empowered by the use of the old technologies. Fang (1997) notes: "Reaction was inevitable from those who must surrender a share of influence and power. They responded both by using the media themselves and by trying to control their use by others." (p. xix). Certainly, this is happening with Bitcoin, too. However, on an unprecedented scale, considering it is a globally occurring phenomenon. The entities that must "surrender a share of power and influence" are global and local. State institutions and financial industries are among the obvious entities who might oppose the adoption of Bitcoin, as it means surrendering a great deal of control. Regulation in varying degrees has been attempted to stop adoption or inhibit the efficacy and usage. Appropriating the technology into the private, centralized banking sector has even been attempted by investment bank JP Morgen Chase (Dockterman, 2013). However, very recently the UK government launched a call for information about digital currencies to which a number of private companies involved with Bitcoin and a number of consultant and educational institutions responded. A report summarizing these responses was published May 2015 and the most notable result of this project is a first recognition that Bitcoin technology (and its derivatives) holds promise:

> *"In response, the government is launching a new research initiative which will bring together the Research Councils, Alan Turing Institute and Digital Catapult with industry in order to address the research opportunities and challenges for digital currency technology, and will increase the research funding in this area by £10 million to support this." (Leadsom, 2015, p. 19)*

This event might be interpreted as an indication that oppression of the adoption or utilization of this medium is no longer a political agenda. Rather, in recognizing its value, the UK government will instead strive to understand and incorporate it into societal structures and financial systems. This development, according to Fang (1997), is indicative of the invention of a technology, which might be considered part of an information revolution as entities in power appears to have attempted to regulate and then use said technology.

Remediation as conceptualized by McLuhan (1964) and further developed by Bolter and Grusin (2000) is touched upon as a vital component in the continuum of information revolutions, as Fang (1997) describes how each new media technology have displaced (but not necessary replaced) some other means of communication due to superiority (p. xviii). As it is not the goal to compare efficacy to determine superior technology or system, the author simply points to the Bitcoin economic ecosystem, which co-exists alongside conventional systems. The conventional systems might be in a process of being displaced, or in the very long term, replaced. In any event, the cases of the UK treasury and JP Morgen Chace might prove as a strong indication of competitive tension between the conventional systems and Bitcoin. The existence of books (and production of new books) in the digital age, might prove an enlightening comparison. The digital and virtual nature of computers are far superior in mediating information, yet books hold tangible values and have practical advantages etc., which is why they persist alongside digital media. Books are sometimes referred to as calm media, due to the lack of interactivity. Fang (1997) observes that: "Within the boundaries of available technology and scientific possibility, communication tools ultimately have become what their users wanted" (p. xix), which can be seen as a testament to the remediating nature of media technologies. In the case of Bitcoin, its iterations and competing alt-coins, the miners (and users to a lesser extend) literally vote if they approve the current state of the software any given time they interact with the medium, democratically determining the state and direction of Bitcoin as a whole. In this continuum, it should also be noted how the transparency and open source nature of Bitcoin has perpetuated this evolution. Refashioning of the Bitcoin protocol due to its openness has created many novel crypto currencies, which compete with Bitcoin.

Discussion & Summary

In entertaining the notion that the inception of Bitcoin might constitute the beginning of a new information revolution, a list of commonalities of such revolutions was compared to the nature and the current understanding of Bitcoin. In all accounts, and in particular in regards to driving egalitarian forces, and displacing geo-centralized power and decentralization, Bitcoin is easily reflected in these media historical features. However, reflection of these observations does not necessary constitute an emerging, new information revolution. Even if the inception of Bitcoin in a time of social and economic mistrust of current financial institutions does describe the prerequisite condition of information revolution in Fang's framework.

Two questions arise in discussing this. Firstly, how progressed in the assimilation and adoption process might Bitcoin be considered. Secondly, Bitcoin might be considered as ushering in an entirely new revolution or might it simply be considered an adherent to the current one, the information highway. To complicate the matters further, information revolutions might have become indistinguishable. Perhaps explained by Moore's Law (1998), the observation that transistor density in computer circuits double every two years, thus growing computational power in an exponential manner, so does information revolutions. The second revolution arrived 1.700 years after the first. However, the last four, each very distinct, have overlapped during the last two centuries according to Fang (1997, p. xviii). The occurrence of revolutions might have

accelerated to such a speed that the boundaries between them have become invisible, or they might seamlessly merge into a continuous narrative.

Because assessing the adoption of Bitcoin would require another scope in and by itself, the author will simply note that Bitcoin adoption is continuous and ongoing. Recognizing, however, that information revolutions might have become somewhat indistinguishable at this point, the author will assert, at the very least, the occurrence and seeming effect of Bitcoin appears to be in alignment with what Fang considers an information revolution. Based on this, it is safe to conclude that Bitcoin is indeed a novel medium. To what extend it might carry significant societal or global change with it remains to be seen.

3.4 Money and Media

Prefacing this discussion, it is necessary to define the two terms utilized, money and currency, as these in the following will be discussed in McLuhan's framework. The former is referred to as a general representative means of exchange of which currency might be considered a subtype, while the latter refers to a system of money, similar to the fiat currency of a nation or Bitcoin. Both money, commodities and currency are considered a medium of exchange.

It may seem unproductive to compare a means of payment with the concept of a medium. Bitcoin is a protocol to mediate a currency (while also being the currency), however at its root, information is being mediated from A to B, not unlike any other medium. However, the McLuhanite definition is far more versatile and liberal than this. McLuhan (1964) offers an example of how a light bulb can be seen as a medium. While he understands the light bulb as a medium without 'content' (unless it is made to project information in the same manner as an overhead projector), it yet becomes crucial for the social interactions, which its light allows for (p. 20-21). In order to transition from the light bulb example to the context of this text, McLuhan offers a more relevant example. In the same manner as the light bulb, currency can be considered a medium as it allows similar social activity and behaviour by providing a means of exchange, based on the value the individuals have given the medium (p. 183-184). Which implies that without human, social interaction by means of the currency (or general money), the medium loses its value. Thus, money can be considered simply a social construct. Social constructivism describes how groups of individuals collaboratively construct knowledge, creating a culture of artefacts, which hold shared meanings within that culture.

The author acknowledges how every currency, medium and system of exchange today shares a social dependency in order to hold any value. The virtual artefact in question is no different. Niall Ferguson (2008), economic historian and professor at Harvard University, writes in his book, The Ascent of Money: "Money is worth only what someone else is willing to give you for it." (p. 18). Ferguson defines money as trust in the next person to accept it as a medium of exchange (ibid). Currency or money, then, becomes a social construct, which derives its value only by the fact that the next person is willing to socially interact with it as a means of exchange. As such, social interaction, or as Ferguson would have it, trust in the next person to accept it, explains how socially constructed artefacts can act as money. The medium that is object for social interaction and trust might be used as a medium of exchange of value, describing a continuum where none can exist without the other. Within the confines of this thesis, this is how the concept of money is looked upon as a type of medium.

In relation to the concept of money, McLuhan (1964) describes how the concept of money developed through three distinct periods. McLuhan refers to the first period as a non-literate society. In this society means of payment are characterized by being material resources, such as gold and whale's teeth and cows. These are considered luxury wares due to their rarity or utility. Literate society, the second period, is characterized by representative means of payment, such as paper notes and coins. These grew out of a need to gain more

mobility of the payment form to support trade across local communities. Also, these new mass produced means of payment is subject to a system, which allowed individuals to easily transform labour into currency or other goods (p. 181-183). As such, the literate society developed a standardized currency in order to support trade, mobility and accumulation of wealth.

The third period, contemporary day, is signified by the replacement of manual labour by electronic labour. McLuhan (1964) describes this using the term automation:

> *"Automation, which is electronic, does not represent physical work and skill as much as*
> *programmed knowledge. As work is replaced by sheer movement of information, money*
> *as a store of work merges with the informational forms of credit and credit card." (p.*
> *188).*

As such, as the *automation* is replacing manual labour, the nature of labour is becoming more about *movement of information*. Of course, this is even truer today than at the time of writing, as the biggest industries in the West undoubtedly are those revolving around information. As the author interprets this, McLuhan asserts that money as a store of work has changed accordingly with the nature of work. Because movement of information, presumably also the production of said information, is the labour of the information age, the currency too reflects this informational property, which causes them to merge. Without regressing too far into a comparable analysis of Bitcoin and conventional currency as a medium of exchange, McLuhan would perhaps look upon Bitcoin as belonging to a new, fourth period, with a novel concept of money, adapted to his global village.

The information age sees a general decentralizing mega trend in human affairs, which Bitcoin through its qualities is seen to accelerate. Media technologies are seen as creating and accelerating this trend towards a decentralized global village. Bitcoin, through its globally boundary-transgressing qualities and efficient information transfer, seem to be better adapted for the global village. Additionally, the very nature of introducing new bitcoins into the system via the miner's computational work might be considered truly informational and immaterial. From this perspective, Bitcoin appears to be natural successor to the conventional currencies.

Discussion & Summary

From section we can assert that monies and media technology can be considered the same class of socially constructed and dependent artefacts. These have no value unless a group or at least two individuals are willing to interact with them as a means of communication. Thus, these artefacts can be considered the same from this perspective, as they only become meaningful, and thus hold value, when they become the object of social interaction. Trust, as Ferguson points out, plays a crucial role in the likelihood of individuals interacting with these socially embedded artefacts. Following McLuhan's logic of money as a store of work, Bitcoin might be considered a new concept of money paradigm due to its informational, boundary-

transgressing and decentralized nature, which at the same time appears to complement his ideal of a global village.

3.5 Chapter Conclusion

Throughout this chapter, historical as well contemporary concepts of media, society and money has been discussed, based on the work of McLuhan and Fang. The nature of Bitcoin has been reflected in these concepts and in the historical narrative of media and society. This provides a tools by which to view and further define Bitcoin as a medium, but also fitting it into a historical media landscape.

In a historical perspective, the inception and introduction of truly new media technologies into a society have had massive social impacts. Fang has observed six of such periods, which appears to increase in frequency of occurrence. Because the development of digital media technology appears to subject to Moore's law, it might be impossible to distinguish between such periods in contemporary day in the same historical manner, Fang has done so far. Common for contemporary scholars of new media, Fang's historical perspective and the media theory framework of McLuhan is a mega trend towards decentralization, which is recognized as the McLuhanite ideal of the global village. Even if it might no longer be possible to gauge the beginning or end of an information revolution, whether Bitcoin constitutes a revolutionizing technology inception or not, the phenomenon at large is easily reflected onto the commonalities of all prior revolutions, and especially in regards to decentralization. Against that background, it does appear to be a new medium with significant social implications and global impact. In time, such discourse regarding the revolutionizing merit of Bitcoin might become more prudent, but at present time it is safe to conclude that Bitcoin does indeed further the ideal of McLuhan's global village at the very least.

In McLuhan's media framework money is a medium, as it both derive meaning and value only because a group of individuals interact with them, making them socially structured and embedded artefacts. Through the double logic of remediation and its democratically governed nature, Bitcoin will ultimately be what its users want it to be. Because of this, Bitcoin is a disruptive phenomenon. Beyond its inherent characteristic as an engine of decentralization, other impacts of Bitcoin become hard to predict as the ecosystem around it is frantically evolving, with different innovations at the edge of the protocol. The readiness with which Bitcoin allows itself to be remediated, repurposed and refashioned due to its open source environment might also be seen as an effect or impact of Bitcoin. These Bitcoin-derived innovations might have their own ecosystems that compete, coexist or complement that of Bitcoin. The Bitcoin-based, evolution-like development of particularly alt-coins might be considered the fourth period in the McLuhanite concept of money due to the informational and immaterial nature of these.

CHAPTER IV – DEFINING THE MEDIUM

4.1 Chapter Introduction

Throughout the prior chapter several important, media theoretic concepts were put into perspective in relation to Bitcoin, but treated on a superficial level. Building onto those concepts, this chapter seeks to define Bitcoin as a medium more in-depth, based on concepts derived from these concepts and principals, in addition to basic post-McLuhan, digital media theory.

Based on the previous chapter, it is obvious that Bitcoin has significant social implications and global impact. An often employed and useful metaphor to describe the continuum from which the protocol exerts its impact is 'ecosystem'. In order to understand the phenomenon that is Bitcoin, it is necessary to map out and create a taxonomy of such an ecosystem. However, with the Bitcoin protocol determining and creating such ecosystems around it, it becomes imperative to gain further understanding of its essence. In order to be able to answer the primary research question, it stands to reason that further enquiry into the nature of the artefact must be taken. This chapter seeks to discuss which properties and qualities might be revealed from defining Bitcoin as a novel medium.

4.2 Media theoretic Discussion

The definition of media has thus far been on a very philosophical level, and might be described simply as the tools or technologies mankind employs to communicate on a common reality across time and space, through overlapping generations. In light of this, media is simply the development consciousness of man as a communicating creature.

In the following, the author will build onto notions brought forth in the preceding chapters. The notion of immateriality, how Bitcoin remediates and represents itself through interactive digital media are topics which must be addressed in order to uncover the nature of Bitcoin, which, through the optics of this thesis, is seen as the determining artefact. The artefact in turn, is seen as being the centre of an ecosystem of innovation, which has disruptive, impactful consequences on society and the individual.

Remediation

As prior discussed (2.4) Bitcoin and its currency is inseparable: the consensus network is based on the currency. The currency, however, might be considered tokens, and thus can be made to denote other types of information. Adhering to the McLuhanite-originated definition of media as that which refashions, appropriates form, function and significance of prior media via the double logic of remediation (Bolter & Grusin, 2000), which means the readiness with which this happens is important. Against this background, the author will argue that the open source development environment of Bitcoin is strongly related to the way in which the medium remediates and allows itself to be remediated, thus becoming an important quality of the medium. Two aspects might be discussed in relation to this and how the phenomenon at large manifests. Firstly, Bitcoin attempts to refashion both the concept of money and the system of fiat currency, being the financial institutions, by providing an alternative trust model build on democracy, in addition to more efficiency. Secondly, Bitcoin is open source and therefor promotes the creation of similar, yet improved versions of itself, as well as improvements upon itself.

The idea of a novel medium bears some discussion as a precursor to the concept of remediation. Cognition theory and behaviourism theory dictates that consciousness operates on two levels: consciously and unconsciously (Bourdieu, 1996), which means that even if an individual intents to consciously conceptualize something quite distinct from what already exists, unconscious operations guide actions. In understanding these unconscious operations, Winnicott and Piaget (2002; 1999) argue that an individual's creation of reality is a product of its experiences within an environment. In turn, these cultural experiences occurs in a connection between the inner reality (consciousness) and external reality (common reality world). Thus, action happens based upon this creation of reality, which can be considered the sum of experiences. In the context of this text, these experiences will inevitably include media technology artefacts. In this manner, creators of media technology are influenced by prior media inceptions. In a larger perspective, the all-inclusive evolution of media technology, might be attributed to generations of media creators' common overlapping consciousness, with increasing frequency creating what Fang (1997) refers to as media

revolutions. However, there may not exist two same notions of nature or essence of the underlying media technologies, only relations and connections on a basic level. This is an important acknowledgement to be mindful of in this task of defining Bitcoin as a *new* medium.

According to Bolter & Grusin (2000), a common strategy of digital technologies is to represent the old in the new by emphasizing the differences rather than erasing them. The new medium is yet validated by containing the old and being an improvement hereof (p. 46). The lines between a new alt-coin and simply an upgraded version of Bitcoin becomes blurry, as both appropriate and improve upon predecessors, while still displaying cultural ties to the conventional financial industries and concepts of money that Bitcoin remediated in 2009. Similar to the way it might be impossible to gauge the beginnings and ends of information revolutions due to the rapid development of technology, so might it become impossible to follow remediation heritage in the Bitcoin space. The only common ancestral denominator of these technologies are Bitcoin. This explosion of evolution-like development based on Bitcoin as progenitor is part of the phenomenon, but discussing all the resulting technologies become unproductive, instead some examples of what the author considers remediations will be described in the following.

The cultural work of defining a new medium may start even before the new medium is conceptualized. According to Bolter & Grusin (2000), technologists may have a sense of where it might fit in the economy of media (what it might remediate). By virtue of the cultural work of defining a new medium: relationships with existing media are unavoidable (p. 66). Which is to mean, a new media technology cannot materialize without relations to old media. Bitcoin is both a transaction system and a currency. The transaction system bears cultural ties to the abovementioned banking institutions. Through its openness, democratizing and decentralized structure, Bitcoin reinvents how trust is generated in this industry and it appears that many individuals see this as an improvement upon conventional systems. This, at least, is representative of one viewpoint of what medium, system or concepts Bitcoin remediated. As prior mentioned (chapter III), Bitcoin itself is being refashioned at a frantic pace.

Bitcoin is recognized as the first successful cryptocurrency, overcoming the double-spending issue (chapter II), but it does not exist in a vacuum. Because any developer is able to download a copy of the open source code and make small alterations to it, the Bitcoin phenomenon has opened up a realm of alternative cryptocurrency concepts. Within the community around cryptocurrencies, these are fittingly referred to as alt-coins and exist in the same economical space as Bitcoin. One such case is Litecoin. Litecoin can be understood as a natural reiteration of the Bitcoin prototype, introducing technical improvements upon the original, thus what one might expect of an improved cryptocurrency. Elaborating upon these technical improvements is beyond the scope of this thesis. Litecoin is branded to be what silver is to gold, which is also indicated by its silver colored icon (Litecoin, 2015).

A recent innovation makes a compelling example for uses of the Bitcoin protocol for other means beyond the financial realm: Storj. According to the developers, "Storj is based on the Bitcoin blockchain technology and peer-to-peer protocols to provide the most secure, private and efficient cloud storage." (Storj, 2014).

While the technology is still under development, it provides key improvements over centralized cloud storage designs. Services, based on the similar open standard development environment of Bitcoin, is already being designed by independent developers, creating the presentation of the edge of this system (Driveshare, 2014; metadisk, 2014). Instead of conventionally storing the data of its users on centralized servers, Storj uses the blockchain and peer-to-peer technology with encryption. Like with Bitcoin, it means that there is no need for a third-party. As such, it remediated the concept of trust in the industry of cloud storage, similar to how Bitcoin does it in the financial industry, while also making it more efficient.

As seen with the examples of Storj and the Litecoin, Bitcoin not only remediates existing media technologies and services, it is itself being rapidly remediated, in a dynamically changing media landscape. While these remediations of Bitcoin cannot be considered a part of the close component of the ecosystem, they certainly are a part of what the author understands as the Bitcoin phenomenon. From a remediation perspective these can be looked upon as an innovation-driven, constantly remediating and changing the impact on societal and global structures.

The perceived immateriality of Bitcoin

Omitting a comparable analysis of other types of media, Bitcoin is often ascribed with properties such as impalpable, intangible and immaterial, because it cannot be perceived with the sense of touch. This will be referred to as the immateriality of Bitcoin. According to media scholar Schaefer (2011), software is often perceived as such, immaterial, due to its seemingly fleeting nature, and resemblance to human language, in its symbolic form. He refers to this property of software as "haptic inconceivability" (p. 64). However, Bitcoin, and software in general, is bound to material, which is to say it is in-material (in physical data containers) despite the perceived immateriality. In addition to this, Schaefer argues that software must also be thought of in terms of materiality due to the fact that is creates a means of production (ibid). As such, labelling software as immaterial creates a conundrum in that it does have very real material impact. This is particularly true with Bitcoin due to its conceived purpose, functioning as a currency. Bitcoin has profound, social impacts that are very real and material.

The mining process that 'produces' or introduces more coins into the system appears to happen with no labor; it does not involve physical labor. The labour required to generate the store of work, that is the currency of Bitcoin, is referred to as immaterial, because it is computational labour and non-physical in nature. In light of the haptic inconceivability of Bitcoin, this notion is up for debate due to the fact that running computational cycles requires the construction and maintenance of very real, in-material computer hardware, including the consumption of electricity.

Retaining the notion that Bitcoin involves immaterial computational labor, immaterial labor is preserved in a digitally derived form (bitcoins), as store of work (even if this labor is non-physical). From this perspective, Bitcoin remediates commodity based economies of a by gone time, which attempted to preserve labor in an exchangeable form. For example, crop harvests, the crop in this example representing the commodity and the harvest, the labor. In effect, Bitcoin can be seen to remediate a commodity based exchange system in the information age, where immaterial labor replaces material labor. The miner metaphor reveals and illuminates this remediation perfectly: the material labor necessitated by working as a real miner is replaced by immaterial labor by the computation cycles required to sustain and mine the Bitcoin network. The product, however, reflects the nature of this labor. For this reason, the author believes, Bitcoin rightfully often referred to as "virtual gold".

Bitcoin as a virtual currency or commodity (as virtual gold) necessitates a discussion into the subject of what the term 'virtual' denotes in relation to bitcoin. Over the course of time, the meanings of virtual multiplied and changed. Following in the vein of new media theory, Lister et al. (2009) argue that the virtual, as a philosophical concept, is not the opposite of the real. The virtual artefact is neither illusory, nor is it unreal. Instead it is a state produced by material technologies, which can interact with our physical senses, meaning it has physical cause-and-effect consequences (p. 124-125). The virtual is not unreal. Rather, it becomes

another type of reality in itself. Bitcoin, as a virtual artefact, or virtual cash or gold, have real world consequences, despite of its haptic inconceivability.

The production of Bitcoin cannot be considered purely immaterial, yet it is definitely not physical labour, Bitcoin is impalpable to the sense of touch, yet the software is in-material and has real, material impact. This is the haptic inconceivability of Bitcoin, and Bitcoin might both be considered material and immaterial. Therefore, Bitcoin is simply defined as a virtual artefact, which denotes a digital type of reality or state, embedded in-material. Bitcoin then becomes a in-materially embedded, virtually represented artefact. A designation applied both to the medium and its content.
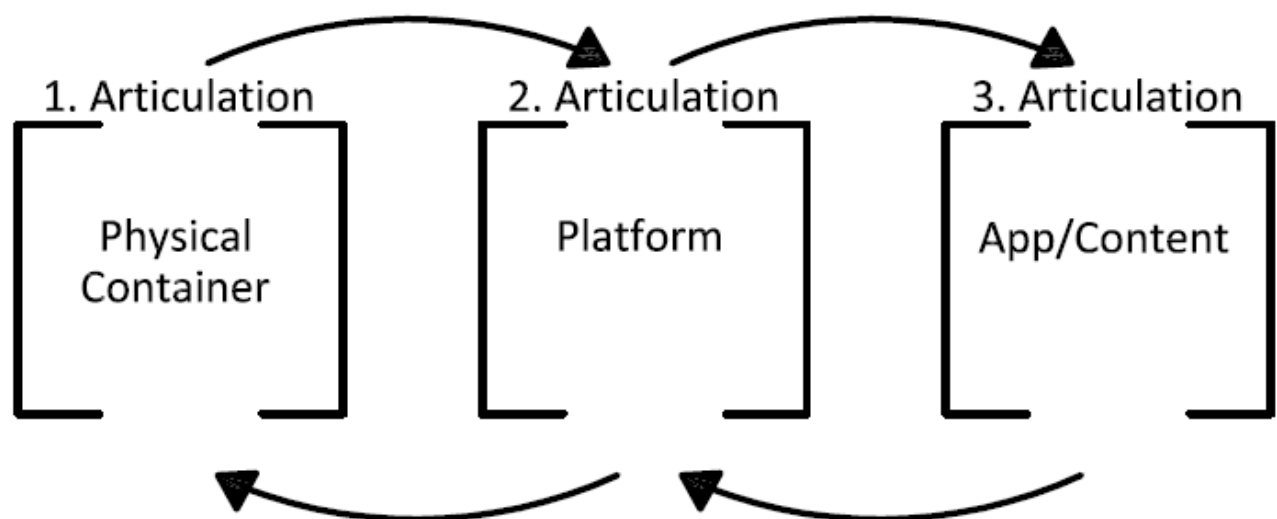
Media articulations

Leaning on domestication theory, which concerns itself with the effect of social and cultural implications of a technology, the idea of media articulations provides a useful tool to distinguish interdepend qualities. According to Haddon and Silverstone (1998), the meanings of a media technology will only reveal itself through a prior articulation of the technology itself, which implies that such technology is characterized by several semantic articulations (p. 68). As such, these semantic articulations are meant to describe different levels of abstraction. While articulation usage varies, the common broad purpose is to map the relation between media in the social context it is embedded into (Jones & Holmes, 2011). Thus, structuralism is adopted as a theoretical paradigm by which to understand human social and cultural elements. The text adheres to the assumption that understanding of human phenomena is only possible by interrelations of said elements within a larger structure. In relation to the Bitcoin protocol, it appears advantageous to adapt such a perspective by which to organize the task of defining and understanding it as a medium. It provides a communicative tool to discuss qualities of the rather abstract medium at large by constructing meaningful semantic articulations, describing the layers which goes into representing Bitcoin.

The concept of media articulations revolve around the relationship referred to as the *double articulation,* which describes the relationship between form (technology) and content. The meaning of content is only available through an articulation of the technology, which is mediating the content (Haddon & Silverstone, 1998), meaning that the content is both dependent on the technology and the content. The implication of this being that the same content might have different meanings based on the 'form' of the technology mediating it. However, the abstract, binary nature of digital media undermines the explanatory ability of this concept. As such, to further understand the virtual nature of Bitcoin, the concept and implication of digital interactive media will be discussed.

In addition, decoding and encoding of content is not only determined by the double articulation of the media technology, it is also determined by the social and cultural context in which this happens. According to Hall's (1973) communications theory, the message of a medium is interpreted (decoded) according to an individual's cultural and economic background, in addition to personal experiences and social context. The

receiver then is in an active engagement of decoding the message into terms that are easily understood. This implies the implication that individuals indeed understand the same message very differently. Thus, the message is encoded and decoded within a given context and mediated through the double articulation of the technology, through several semantic layers.

Expanding on the concept of media as being double articulated, the author considers a popular media framework to distinguish between these levels on digital media is proposed and used by Finnemann (2005) and Haddon & Silverstone (1998): the meanings of a media technology is to be understood by three elements. First, the technology: as the physical object or container. Secondly, platform: as the software, which runs on the physical container. Thirdly, the content: as the digital, encoded message, allowed by the software. Although these articulations describe separate levels, they are still considered interdepended. Similarly, Bitcoin as medium and content is seen as inseparable, thus interdependent. This relationship is depicted in the following model:

Figur 3

A preliminary application of this model to describe the Bitcoin medium would place a smartphone as the physical container, android as an operative system on which to run a wallet app, through which the block chain would be represented as the content. While this text has an obvious focus on the third articulation in this model, all articulations hold semantic value in defining the medium, as it is represented through meaning derived on the basis of all three. In addition, the versatility of this model begs an adaptation to the specific medium in question. By second glance, in describing the relationships between the articulations of Bitcoin, issues arise with this model. Abstracting to the utmost articulation of Bitcoin, first articulation, it becomes a matter of perspective, which is unique to the individual user. Miner users and regular users of wallets interface differently with the medium. A discussion found in the appendix addresses this (Appendix 2).

Interactive digital media

Because Bitcoin is embedded in and represented in-material by interactive digital media technologies, the concept of such will be discussed as it defines the nature of the in-material container. The crucial feature of digital media is interactivity. The humanistic faculty adherence of this text compels the definition of Jens F. Jensen (1997), which states that interactive digital media is characterized by the medium's ability to allow the user to influence the mediated communication's form and content (p. 54). Thus, the user is able to not only form the mediation of the content, but is also able to create it dynamically. As such, based on the interactive digital nature of the thrice articulated media framework, this means that encoding and decoding (anchored in a certain cultural and social context) happens at three distinct, yet interdepended, articulated levels with each its own semiotic system. Thus, meaning is created in a complex network of semantic relations when dealing with digital media.

The implication in regards to the abstract, binary nature of digital media is that it has the ability to produce an unlimited amount of representations as Finnemann (2005) considers the digital medium a blank informational, sign system (p. 70). Due to the binary alphabet, of which semiotic system of digital media is constructed, it can potentially assume all possible presentation forms and contain all other types of media. As opposed to formational sign systems, informational systems consist of '1' and '0' (representing two states) the implication of which being that it has no inherent meaning. The media technology is only given meaning when an external instance configures (programs) it arbitrarily. This quality can be referred to a hypermediacy. According to Bolter & Grusin (2000):

> *"Contemporary hypermediacy offers a heterogeneous space, in which representation is*
> *conceived of not as a window on the world, but rather as 'windowed' itself – with*
> *windows that open on the other representations or other media. The logic of*
> *hypermediacy multiplies the signs of mediation and in this way tries to reproduce the*
> *rich sensorium of human experience" (p. 34)*

The contemporary concept of hypermediacy is defined as enhancing the way media attempts to reproduce "the rich sensorium of human experience", which is referencing the claim of McLuhan (1964), that media should be conceived of as extensions of the human body. In other words, the inherent meaningless, informational sign system of computers are driving the new media technology paradigm, which attempts to reproduce the human experience through unlimited representations made up of '0' and '1'. The cited analogy of windows that open on other representations or media technologies is important in discussing and defining Bitcoin, as the representation of Bitcoin is projected onto many such through it being a networked, in-material medium. The open source and API-friendly nature of Bitcoin makes it possible for users and developers to create and use the content in many forms, through many containers, as developers have full

access to source code and highly networked API tools. As such, Bitcoin can be mediated through many forms, while allowing itself to readily be remediated.

Another way of defining Bitcoin, specifically through its discussed nature of being digital and interactive (and readily remediates), would be to fit it into already articulated and established categories of media. One might consider the media types as discussed by Klaus Bruun Jensen, professor at Københavns Universitet, which is a system for defining types of media into three categories or degrees. According to Jensen (2006), media might be categorised into three degrees. Media of 1st degree is defined biologically based and socially formed, enabling individuals to communicate with one another. Examples of this category of media includes dance, drama, music and the primary example, speech. A prerequisite of this type of media is the presence of the human body in time and space of the given communication situation. Media of 2nd degree are categorised by technically, in many cases standardized, reproduced media forms. As opposed to unique paintings, these media types are usually mass produced forms such as newspaper and books, while also including mass broadcasting media such as radio and cinema. Media of 3rd degree are categorised by being interactive and digital in nature, and often incorporate (remediate) lower degrees of media forms in a digital manner, making them digitally reproduced. Based on this definition media degree categorization, it is clear that Bitcoin belongs to that of 3rd degree.

4.3 Chapter Conclusion

This chapter discusses the properties and qualities which signify and define Bitcoin as a medium in the optic of the author while also addressing the nature of the new, guided by the research question; which properties and qualities might be revealed from defining Bitcoin as a novel medium?

In understanding how bitcoin, and its continuous development and remediations, come about, cognitive theory dictates that this novel idea is created on two levels, defined broadly as inner reality and external reality. As Lister et al. (2000) describes remediation in greater detail, how it pertains to a creators experience with other technologies, as dictated by presented cognitive theory, but also how this reflects upon the notion of information revolutions, by Fang (1997). Remediation might not be considered a property or quality specific to Bitcoin, as this appears to be inherent to all media technology. However, the open source, egalitarian philosophy by which Bitcoin is created and is coded into the protocol, significantly promotes this quality.

The media articulated complexity of Bitcoin, which is characterized by not only complex semantic relationships between the possible layers, but several user types, encoding and decoding information in unique socially and culturally anchored contexts. In this light, the author considers an important characteristic of Bitcoin to be its hyperactive remediating quality. The media articulations serves the purpose of describing the many forms a virtual artefact such as Bitcoin might take or remediate into due to informational nature of code. In addition, although perhaps not conceptually accurate to the nature of a medium, the development environment around Bitcoin, perpetuates and promotes the production and proliferation of its representations. This might also be seen as a quality or property of Bitcoin, the author will argue, as this is simply the result of it being a virtual, easily reproduced artefact. The lines between remediation, as a complete repurposing and refashioning of the protocol, and simply shaping how it is represented through the articulations, becomes blurry by the current defined parameters.

The interactive and global boundary-transgressing digital nature Bitcoin enables interaction between users, ignoring limitations of time and space, cultural and political barriers. This further drives value creation and remediation, as money within the context of this thesis is seen as a social construct, which derives its value only because individuals are willing to socially interact with it as a means of exchange. This gives the currency of Bitcoin, as well as all other mediums value. As such, it is considered an important characteristic, as the medium would not exist without such social interaction. From a new media perspective, the result of this is Bitcoin becoming a vehicle of globalization and shifting in geopolitical power structures.

The nature of Bitcoin has been established as virtual as it is represented in-material, while being intangible, yet has real material impact and value. The meaning of virtual, as a new type of artefact in itself, which appears to describe this haptic inconceivability of software, appears to be an applicable designation of the nature of Bitcoin. Due to the virtual, thus informational nature of the protocol, which exists in an open source

developmental space that makes it very susceptible to remediation, both upon itself and of itself, the boundaries between remediation and representation in different forms become blurred. The presented examples (Storj & Litecoin) repurposed and refashioned in starkly different ways, yet hold strong cultural ties to Bitcoin. An alternative way of defining Bitcoin and its remediation, can be to simply refer to them commonly as mediums of 3rd degree.

CHAPTER V – BITCOIN AS AN ECOSYSTEM

5.1 Chapter introduction

Throughout previous chapter, the nature of Bitcoin was investigated and the effect of this discussed and exemplified through the media articulation model as well as exemplifications of actual remediation. Throughout the chapters thus far, the notion put forth in in second chapter, a consensus that Bitcoin might advantageously be looked upon as an ecosystem should be apparent. Based on the definition of Bitcoin as a medium, gained from prior chapter (chapter IV) this chapter will focus on structuring a conceptual framework to describe and organize the phenomenon of Bitcoin. The utility of this might allow for making postulations about the social impact of Bitcoin, from the media perspective of this thesis, in an organized manner.

In understanding Bitcoin as an ecosystem, several enquiries arise. Firstly, what is an ecosystem and secondly, how can Bitcoin be understood as such. While discussing and devising this, the implications and advantages of utilizing such a metaphor will be revealed. It is an attempt of organizing the phenomenon with Bitcoin at the centre, determining and creating the space around it. Thus, the secondary research question guiding this chapter is: based upon the definition of Bitcoin as a medium, how might a conceptual framework be structured to understand the phenomenon?

5.2 Bitcoin and the ecosystem metaphor

Inspired by Lars Holdgaard's (2014) master thesis, *An Exploration of the Bitcoin Ecosystem* from Copenhagen Business Institute, this text will attempt a similar approach to approximate a description and a mode of impact of the phenomenon from a media theoretic perspective. The term ecosystem originates from biology and simply indicates that it is unproductive to observe a single unit in order to gain knowledge of a larger phenomenon. By utilizing this term in a scientific domain, it is sought to explore the phenomenon in a broader, systemic manner. There exists a number of variations of scientific ecosystems, domestic to specific and overlapping academic fields of study and industries. The author considers the digital ecosystem a valid framework as it appears to compliment the presented initial understanding of the Bitcoin phenomenon well (1.3). While still an emergent concept, some consensus seems to exist about said ecosystems. According to the European Commission, the digital ecosystem model is informed by natural ecosystems. Properties, such as self-organization, scalability and sustainability is a product of its distributed, open socio-technical nature (Dini et al., 2010). The ecosystem metaphor appears to have merit as a means to describe relations and perspectives within a fitting context. The author will attempt to utilize this ecosystem metaphor to describe the Bitcoin phenomenon. Thus, it will serve as the model for relating, identifying and discussing constituents of the Bitcoin phenomenon. In this case, the ecosystem will be used in a retrospective manner to describe the phenomenon, which is seen as having grown organically from the conception of the Bitcoin protocol.

5.3 The applicability of the ecosystem metaphor

Existing ecosystem models are not only domestic to specific domains of study or industry; they are also specific in scale and focus. Most ecosystem models are discussed from a business or biological perspective. While admittedly, a business perspective is of some interest to this text, as it pertains to mechanisms of adoption, sustainability and growth, a unilateral focus on this is unproductive for this text's scope. Another noteworthy disclaimer, a majority of papers revolves around facilitating the creation and evolvement of an ecosystem (Dini et al., 2010; Selander et al., 2010; Moore, 1996; Hedmann & Henningsson, 2013). While this is a significant barrier, the commentary and experiences from such projects are valuable to this text. The goal then becomes to operationalize and adapt the business oriented ecosystem, and the concept of an ecosystem in general, within the scope of this text for the phenomenon of Bitcoin.

While, both Moore's (1996) *business* ecosystem and the digital ecosystem are modelled to describe primarily business interests, some important aspects can be extrapolated. As such, the definition of business ecosystem is described as being an economic community of interfacing organizations and individuals. The economic community creates goods and services of value to customers inside the ecosystem. The member organisms of said ecosystem includes various producers of value, customers, competitors and stakeholders. These will coevolve their roles and capabilities for the common good of the ecosystem by forming mutually beneficial supportive roles (Moore, 1996, p. 6). Certainly, the same symbiotic relationships exist and evolves between important actors in the Bitcoin ecosystem in order to create value for all actors and further adoption of the medium. Moreover, according to Selander et al. (2010), the dynamics of digital ecosystem are characterized by competition, collaboration and tension among actors, further compelling the necessity of an ecosystem model metaphor in exploring the phenomenon. APIs developed by third party actors within the Bitcoin community, both serving to compete and collaborate, is reflecting this statement.

While not directly applicable to the context of this text, it is possible to gleam important aspects of digital business ecosystem development, from the paper by the European Commission, which seems to indicate similarities between said ecosystem and the Bitcoin phenomenon, as the author understands it. According to Dini et al. (2010):

> *"... the 'openness' of ecosystem development itself is a key quality. The quality of openness refers not only to disclosing software source code, it includes the broader processes relating to software and infrastructure development, and also to modes of governance through which the ecosystem will be sustained. "(p. 6)*

As both the open source Bitcoin protocol and the key technology herein, the blockchain, is publicly available, the Bitcoin phenomenon appears to be well aligned with a quality, which according to the European Commission is considered very important for the success of any ecosystem.

The details of the findings of FP7[3] workshop held in Bruxelles 18 April 2005, about the infrastructure requirement characteristics of a digital business ecosystem, are too cumbersome to elaborate here. However, these listed characteristics are mostly reflected in Bitcoin, and is described these in bullet point form:

- 1. Global solutions with a local input and sector approach
- 2. No single point of failure and control
- 3. Commitment to open source and open standards
- 4. Long-term credibility and attractive brand
- 5. Utilization of proven technologies
- 6. Simple on the surface, performant technology underneath
- 7. Sufficient trust and identity management and data security
- 8. Proven business cases and benefits for service providers and service users
- 9. Allows open entry to new territorial markets (Dini et al., 2005, pp. 9-10)

The scope of this enquiry into ecosystem characteristics is limited to have a focus on local, European SMEs in a business context, which is reflected in bullet no. 1, 4 and 8. The remaining bullet points appear to describe Bitcoin well, based on the introductory description of Bitcoin. Assuming that an ecosystem indeed exists around Bitcoin, the conclusions of this workshop appears to be proven correct by the conception of Bitcoin and the subsequent emerging ecosystem around it only a few years later. The author recognizes this observation as evidence that an ecosystem scaffolding model to describe the Bitcoin phenomenon proves useful.

Finally, the aforementioned properties of a digital business ecosystem: adaptive self-organization, scalability and sustainability, as a product of an open source, distributed nature (Dini et al., 2005), are easily reflected in Bitcoin:

- Self-organization refers to the phenomenon where an initially disordered open system spontaneously adapts to stimuli, not directed by one single actor, creating order. The resulting organization is entirely decentralized or distributed, not unlike Bitcoin, which appears to share these properties.
- Scalability refers to the ability of a system to adapt to and accommodate growth. A distributed or decentralized system inherently retain this ability, as the network is not limited by one single point, but rather adapts and become more robust as more nodes or actors join the network. While it is not completely clear, and beyond the scope of this text to comment on the technical side of the protocol, it seems apparent that Bitcoin have this ability. Certainly, from a social and political perspective, the more actors invested and interested in the protocol, the more robust it becomes.

---

[3] Abbreviation of seventh framework programme of the European Union, focused on research and technological development in Europe.

- Sustainability refers to a system, which operates in a manner so that it does not use up resources faster than they can be replenished. This property is problematic to reflect on, as it conveys many interpretations, such as environmental, economic, organization and social, which all seem to hold value in this discourse. While this question is too cumbersome to reflect about in all its facets, from an economic perspective it would seem that Bitcoin is magnitudes more sustainable than conventional economic structures. In terms of 'staying power', which in the author's experience is the quality most often referred to with this term; its decentralized structure makes it resilient against centralized attacks.
- Bitcoin is open source, allowing any interested entity to contribute, collaborate and develop as an actor within the system. Self-organization and scalability seems arises from these properties, while adaptability, can be considered an inherent property and a requirement of these. Based on this, it would appear as if Bitcoin to a large extend qualifies to be regarded as an ecosystem, and thus treated as such in the framework.

Further, the open source development philosophy itself might be viewed in evolutionary terms, as suggested by Johari and Kaur (2011). Through constant iterations, ongoing revisions and improvements, such computer software evolve in a competitive manner with other software in the same space. From this perspective, an open-source developer instil software with the capability to have binary off-springs by inviting developers in the same space to create improvements upon the original software, perhaps adapting to a shifting environment, much like a biological species. Viewing Bitcoin in this light means that all subsequent permutations of the protocol, be it an alt-coin or a derivative technology, which shares the same core constituents might be considered a descendant of this same structure or medium. The notion of open source development as similar to evolutionary, biological concepts further compels the argument that phenomenon of Bitcoin might be understood as an ecosystem.

5.4 Ecosystem on different levels

By utilizing the ecosystem metaphor as an organizing scheme to describe and analyze the phenomenon, the design of an ecosystem model is implied. Such a model acts as a visual representation of the real system that is being studied (Hall & Day, 1990, p 7-8). In addition, the design of such a model creates an important tool, from which to populate and relate the organism of the ecosystem in an organized manner.

In order to design a model, the author turns to fundamental ecosystem theory from biology. In the work '*An Introduction to Ecological Modelling: Putting Practice into Theory'*, by Gillman and Hails (1997), the authors point to the fact that ecosystems consist of an enormous amounts of factors, which all interact in unexpected ways. While this text will not attempt to compare the levels of complexity of environmental biology to that of digital phenomena, it seems the same challenges of complexity exists. Complexity generally characterize phenomena with numerous constituents that interact in multiple, unpredictable ways. In biological ecosystem modelling, this issue is addressed through a process of simplifying the system to a limited number of well-articulated constituents that are deemed important to solve the problem. In order to create a framework to simply approach an understanding of the Bitcoin phenomenon, it is clear that the model must contain very few, explicitly defined constituents. Given the dynamic developmental nature of Bitcoin, it becomes even more important to identify rather static factors to focus on.

By exploring existing literature in the field of digital business ecosystems, the author discovered and leans upon the work by Henningsson and Hedmann (2013), of the Department of IT Management, Copenhagen Business School. In the article *Transformation of Digital Ecosystems: The case of Digital Payments*, they propose a framework model for explaining technology based transformation and creation of ecosystems. This framework aims to reproduce ecosystem transformation as a distributed and emergent phenomenon. As such, the ecosystem emerges from micro-, through meso-, to macro-level, referred to as the DETT framework (Digital Ecosystem Technology Transformation):

- At the micro-level individuals units, seen as companies, exist and compete for value creation.
- At the meso-level, these individual units become social entities and create opportunities and value through collaboration in the ecosystem.
- At the macro-level, all actors in the ecosystem are perceived in its entirety and the ecosystem competes with other ecosystems.
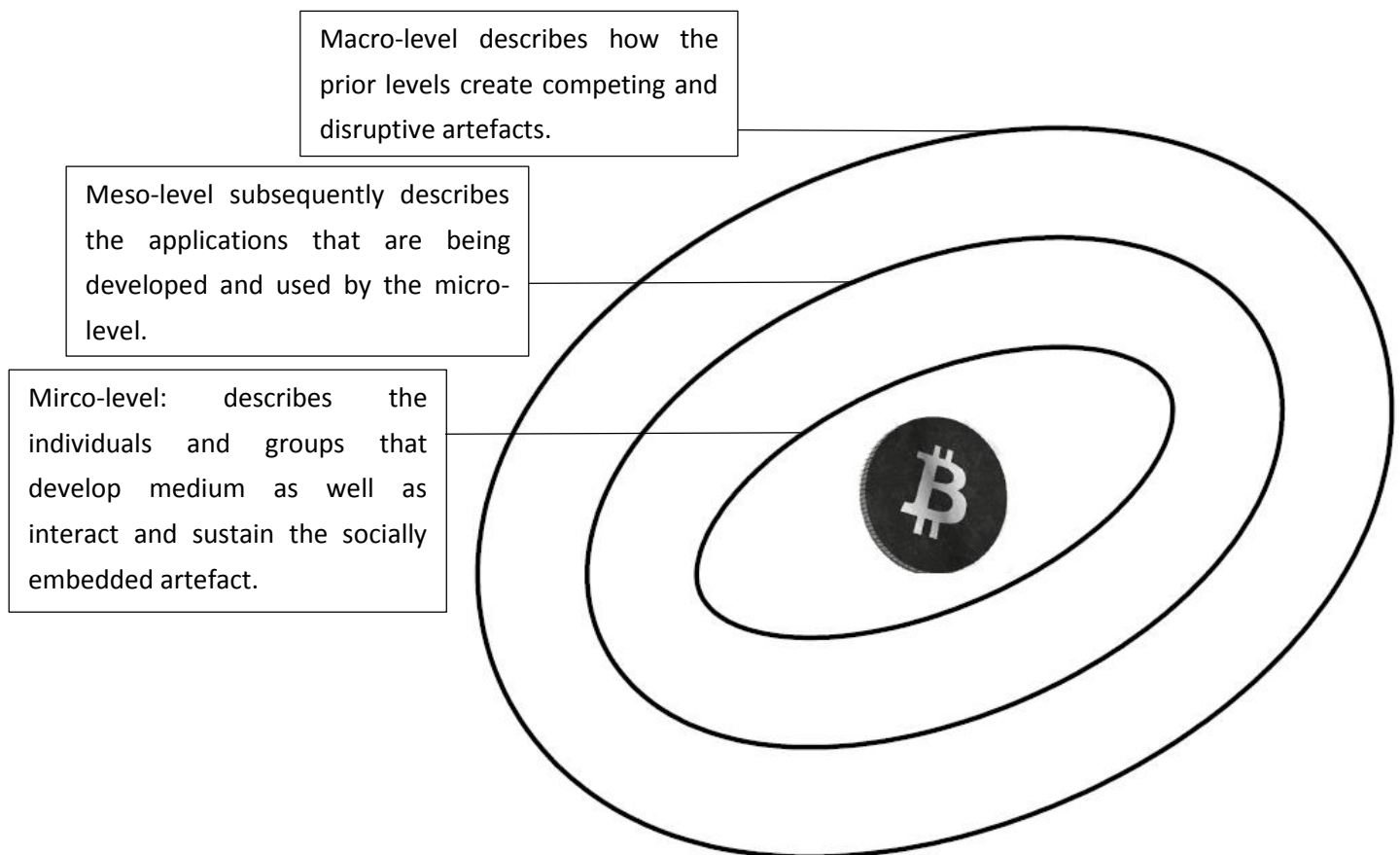
Such an organizational and descriptive strategy appears to form a useful scaffolding, showing how Bitcoin might emerge from an individual, personal level into an institutional level. When relating this to the phenomenon of Bitcoin, it seems clear that all three levels, or perspectives, have the potential to yield valuable information in understanding said phenomenon. These levels seem easily reflected in the optics and goals of this text by creatively reapplying meaningful designations:

- The micro-level describes the various individual users, groups and developers, the individuals that interact and sustain the socially constructed and dependent artefact. The designation of this level as such is unavoidable, because the medium is both given meaning and value through social interactions. Further, this level is describes how the open source culture drives and develops the different experiences at the edge of the protocol, while also remediating and repurposing the protocol in its entirety.
- The meso-level, subsequently, consists of and describes the different permutations of the edge of the protocol, which is developed and reproduced at the micro-level. Conceptually, this describes the services which can be produced at the edge of the protocol (applications), and subsequently bears strong relations to the micro-level. Collaboration and competition between these services is assumed, as they fight for adoption by the individuals and groups of individuals residing at the micro-level.
- The macro-level describes and reflects upon the ecosystem on an institutional and industry-specific level where Bitcoin is seen to be disruptive and competitive to established institutional structures, which is a perspective very similar to the original level description. In addition, remediations, which compete against or collaborate with Bitcoin in adoption and exist in their own ecosystem, is also inhabiting this level and seen as a disruptive force. These are derived from Bitcoin and they hold strong cultural ties and therefore some levels of their ecosystems might overlap with that of Bitcoin. Particularly, the first level. Individuals users who interacts with a competing alt-coins, might also hold bitcoins. In addition, the meso-level of such an alt-coin, might share many of the same interfaces, wallets, as Bitcoin, showing the possibility of overlap. These two competing wallets might even exist within the same application.

5.5 Chapter conclusion

Basing the framework on the ecosystem structural paradigm is taking an eclectic, creative leap. However, due to the striking similarities, set forth by the EU commission (Dini et al. 2005), between Bitcoin and healthy digital ecosystems, it is a compelling to use this metaphor and approach to device a framework by which to approach the task of understanding the phenomenon. As seen in this chapter, Bitcoin resembles to a very large degree digital business ecosystems. The organization scheme of ecosystems imply a model and further expanding on the ecosystem paradigm, the DETT model was adapted and operationalized into what is considered a valuable organizational framework. The entire operationalizing of the Bitcoin phenomenon into an ecosystem paradigm relies on the perceived similarities between the two. However, the author believe to have justified such an operationalization through the preceding chapter and established reasonable applicability.

By creatively adapting the digital business ecosystem model, more specifically the DETT model by Henningsson and Hedmann (2013), creating a level-wise reference scaffolding for the organization and possible impact of the Bitcoin medium, aiming to portray the different layers of implications. The author believes that a model with these level-wise constituents keep the complexity level manageable, while still addressing the research question driving the narrative in this chapter: how might a conceptual framework be structured to understand the phenomenon? The conclusions of this chapter will be further elaborated on in the final chapter. A model describing the level-wise DETT Bitcoin-adapted ecosystem is seen below:

Macro-level describes how the prior levels create competing and disruptive artefacts.

Meso-level subsequently describes the applications that are being developed and used by the micro-level.

Mirco-level: describes the individuals and groups that develop medium as well as interact and sustain the socially embedded artefact.

CHAPTER VI – CONTRIBUTING TO THE DISCUSSION

6.1 Chapter introduction

Throughout the preceding chapters, the academic product, although not formally concluded yet, has been composed, and the purpose of this chapter is to briefly address the method or approach by which this product might enter into the ongoing discourse of Bitcoin. The purpose of this is to be able to contribute to this discussion with the goal of increasing public awareness and understanding in regards to the phenomenon of Bitcoin. As opposed to the academic product, this takes the form of a practical enterprise. The research question addressed in this chapter is; how might answering these research questions contribute to more public awareness and understanding in regards to the Bitcoin phenomenon?

6.2 Bitcoin research challenge

Scholarly papers should generally rely on peer-reviewed, scholarly work vetted by experts in the field. The author has attempted to do this to a large degree. Though, the instance of the Bitcoin phenomenon, to a large extend, defies such neat centralized, peer-reviewed definition. The fact that Bitcoin is a decentralized technology, both in development and function, and the subsequent phenomenon around it presumably share this characteristic, represents a conundrum. The study of most other media technologies focuses on a single, centralized artefact or a collection of artefacts from a centralized point of origin. In turn, this point of origin is able to provide a vision and definition of the artefact in question. With Bitcoin however, there is no single point of reference for information gathering, with the exception of the original white paper. Additionally, the body of research pertaining to the scope of this thesis is limited and very specific to delimited topics.

The Bitcoin medium might be considered an open source, collaborative effort. In order to identify an approach to enter into a discussion about phenomenon this technology has become, it appears advantageous to attempt to mirror the same mechanics. As such, the text proposes a peer-based mode of production within a framework based on the ethnographic tradition, adapted to the computer-mediated communications of the internet. The purpose of this is to enter into the discourse regarding Bitcoin, gain feedback and further information pertaining to the topic of this text.

The author attempts, to some extent, to mimic the environment in which Bitcoin itself was created. As Bitcoin was created in a collaborative effort, so is present text of the conviction that this enterprise cannot be undertaken properly in a creative vacuum (of one subjective author). Such a perspective fits well into the explorative case study paradigm, which represents a framework seemingly able to contain this idea:

> *" … qualitative case study is an approach to research that facilitates exploration of a phenomenon within its context using a variety of data sources. This ensures that the issue is not explored through one lens, but rather a variety of lenses which allows for multiple facets of the phenomenon to be revealed and understood." (Baxter & Jack, 2008, p. 544)*

As such, this might be considered an attempt to treat the further development of the perspectives and definitions of Bitcoin, or rather the academic product of this thesis, as a case study, extending past the concluded information in this text.

6.3 Peer production

Benkler and Nissenbaum (2006) describes a type of collaborative social system, dubbed 'commons-based peer production' in *The Journal of Political Philosophy.* The authors define the phenomenon as: "[...] a socio-economic system of production that is emerging in the digitally networked environment" (p. 394). The concept of peer production is described in the article as an emerging phenomenon. Present day, however, almost 10 years after the authors coined the term, it appears more to be the prevalent feature of the internet. The phenomenon of peer production is characterized by collaboration between a large pool of individuals, facilitated by the internet infrastructure, to distribute information, create knowledge or cultural goods without relying on market managerial hierarchies. Such digitally networked environments describes exactly the development environment Bitcoin was conceptualized and produced from within, commonly referred to open source communities. According to the authors, this type of social peer production is emerging alongside, and in competition with, contract- and market-based, managerial-firm based and state-based production systems (p. 400). In the case of Bitcoin, it is not only the production system, which is in competition to established, conventional means of production, the end product (which is not clearly distinguishable from the production) appears to inherit this feature of being in competition with conventional systems. Notably, the authors recognized the disruptive potential of this new mode of production:

> *"Because this decentralized, peer production system obviates the need for centralized capital investment, this capital structure makes possible (while it does not necessarily require it) the reorganization of at least some information and cultural production towards decentralized structures."(p. 400)*

Benkler and Nissenbaum (2006) ascribe this concept to wide variety of production types. They argue that common-based peer production can take many shapes and exemplifies this with the instance of Linux distributions, as distributed software development, and SETI@home as distributed volunteer computing (p. 395-396). Behaviour in the collaborative, common effort production, is brought on by a common enterprise coupled with a thoroughly transparent platform, "that faithfully records and renders all individual interventions in the common project and facilitates discourse among participants about their contributions do, or do not, contribute to this common enterprise." (p. 398). Benkler and Nissenbaum (2006) uses the advent of Wikipedia.org to further describe the nature of peer production:

> *"[...] its most interesting characteristic is the self-conscious use of open discourse, usually aimed at consensus, and heavy reliance on social norms and user-run quasi-formal mediation and arbitration, rather than on mechanical control of behaviour."(p. 398)*

Recognizing and understanding this mode of production is especially appealing to the text due to the explorative approach of practical product. The authors describe a significant advantage over conventional production systems, as peer production allows individuals to self-identify their worth in tasks or discussions, which allows more dynamic information, referred to by the authors as the "variability of human creativity"

(p. 402). Promoting creative inputs by peers should prove useful in a decidedly explorative enterprise, thus far directed by the input of only one author.

6.4 Operationalizing peer production

Peer production is signified by two core concepts. Most notable, decentralization, as authority to act resides with individual agents faced with opportunities for action. Second core concept is that these systems use social cues and motivations, in place of monetary incentives or commands, to motivate and coordinate the action of participating agents (Benkler & Nissenbaum, 2006, p. 400). The aim of the text is to employ social community platforms and the highly interactive Wordpress publishing platform, which both promotes already established social systems (with build-in cues and motivations), while also enabling a large pool of individual agents to be faced with an opportunity to contribute (Wordpress, 2015). Besides publishing on the Wordpress platform, the author aims to link to the platform from larger Bitcoin-focused communities, residing on other social platforms, in order to gain a wider reach of exposure. Wordpress is not as highly oriented towards commons-based peer production as some of the examples, but it does retain key elements. In addition, Wordpress might simply be seen as an interactive platform by which to publish the information, which then is subject to being discussed on platforms that lend themselves even better to this mode of production.

Benkler and Nissenbaum (2006) present two often observed, important structural attributes of peer production systems. The objects of peer production must be modular and able to be produced incrementally and independently. The relative size of said modules or increments, referred to as the granularity, is important, as smaller modules require less attention and work from participants or contributors. This allows the project to draw on a greater pool of volunteers whose motivation level will not sustain more than smaller efforts (p. 401). The obvious advantage of this being that the potential pool of individuals able to contribute becomes larger, as more people, with different capabilities, variable time and availability may choose to contribute. As such, it appears imperative to employ a modular approach with smaller text pieces. Because of this (and because of common text formation), this thesis has been fragmented into many sections (within chapters), which, for the most part, might be addressed individually and the author aims to do so.

Another significant structural attribute of peer systems is the low-cost integration method of the modular constituents into the project in its entirety. This integration, according to the authors, must include quality control over the modules and a mechanism of integration (Benkler & Nissenbaum, 2006, p. 402). Enormous Peer production projects as Wikipedia.org require such intricate mechanisms, both for implementing and assuring quality control. In the instance of this thesis, the author will act both as main quality control and mechanism of integration. However, some sense of quality control might still occur among the participants, as the contributions on the chosen platform will be subject to open and transparent discourse, which according to the authors promote consensus formation. For example, Wordpress, Reddit (reddit.com), common fora and similar web 2.0 platforms. In particular, the platform Reddit has been an interest of the author to employ this approach to. An introduction, utilizing aspects of digital ethnography, to the platform and how it might be approached in general, see appendix (appendix 3).

In discussing the incentive mechanisms in the context of voluntarism behaviour, a central characteristic of peer production contributing individuals is that they appear to be motivated by non-price based incentives. In fact, the authors argue that common-based enterprises per definition are non-priced based (Benkler & Nissenbaum, 2006, p. 402). Alternative modes of incentive mechanisms are driving the voluntarism behaviour employed in such enterprises. The Benkler and Nissenbaum (2006, p. 403) suggest a range of motives for contributions. In the context of Bitcoin, the following becomes relevant: learning, reputation, sense of purpose, possible future financial gain, or simply for social relations and companionship in a common enterprise to further the ideals of the decentralized and transparent philosophy of Bitcoin. In the case of Bitcoin focused communities, it is the authors experience that ideology often times appears to be a powerful incentive in driving voluntarism behaviour.

6.5 Chapter conclusion

In answering the research question; how might answering these research questions contribute to more public awareness and understanding in regards to the Bitcoin phenomenon? The author concludes, the described methodology is an attempt to mitigate the challenge prompted by the lack of a centralized resources for Bitcoin information. The author aims to publish the relevant sections of the thesis and seek feedback and creative inputs from the Bitcoin-oriented communities. In this manner, the product of this thesis remains in its final academic form, while simultaneously entering into an ongoing discourse about Bitcoin, extending past the information produced in this thesis.

The advantages of the common-based peer production and explorative approach in entering into and sharing the discussion about Bitcoin might be summarized as such:

- The Wordpress platform is an interactive web interface, which provides an easy way of sharing the knowledge learned throughout academic product, while also allowing for feedback on the platform itself.
- It crowd-sources ideas and knowledge in a fast evolving environment without a central point of reference.
- Peer production contributing individuals appear to be motivated by non-price based incentives, in addition to social cues and motivations in the platforms built for, or subject to this phenomenon.
- It promotes consensus formation among a large pool of individuals, while still allowing for a sense of quality control.

The goal, to reach a wide audience in order enter into and interact with community, also compelled the decision to write this thesis in the language of English, as opposed to Danish. As Danish would not lend itself well to an international discussion, or knowledge dissemination, about Bitcoin. The practical product resides on the domain name: www.bitcoin-research.com on a Wordpress platform.

CHAPTER VII – CONCLUSION

7.1 Conclusion

Following the logic in the venn-diagram (1.4), represented by the three preceding chapters, each addressing one of the research questions pertaining to the academic product, the overlap creates an understanding of the Bitcoin phenomenon. Based on the chosen theory, an emerging understand and definition of the Bitcoin phenomenon emerges. Instead of addressing each research question separately, as has already been done in the chapter conclusions throughout this text, this will be an attempt of creating a holistic, all-encompassing conclusion, to the main research question; what is the Bitcoin phenomenon? This is the academic product of the thesis. While not individually addressed, the research question are listed below.

1. What is Bitcoin?

2. How might Bitcoin be viewed in a basic media-historical perspective?

3. In light of this perspective, which properties and qualities might be revealed from defining Bitcoin as a novel medium?

4. Based upon the definition of Bitcoin as a medium, how might a conceptual framework be structured to understand the phenomenon?

Academic product

Throughout this text, Bitcoin has been addressed both as a medium and a phenomenon, because it is both. However, a distinction in this might be made, as Bitcoin as a phenomenon can be discussed quite separately from Bitcoin as a medium. However, the qualities and properties of Bitcoin as a medium, reflect on it as a phenomenon, as causative in the emergence of the phenomenon. Following this, the ecosystem model was developed to describe this phenomenon in a structural manner with Bitcoin as a medium at its core.

Throughout the second chapter, the author presents a preliminary description and definition of the Bitcoin protocol from a predominantly technical perspective, describing the technology and to some extend the environment in which it is created. Here Bitcoin is described as being an innovative, potentially paradigm shifting inception. This innovation enables peer to peer transactions of information between anyone, anywhere. In a historical context, Bitcoin represents a prototype for the first technology that allows for proof of ownership of digital assets without trusted third parties. This innovation enables peer to peer transactions of information between anyone, anywhere. As such, whereas the content of Bitcoin, or the blockchain, is a currency, these tokens can be made to represent any imaginable piece of information. Instead of relying on intermediary sources, information can be stored directly in the distributed ledger and accessed from this point, circumventing gatekeepers and free of manipulation, or contextually misleading information. The many possible implications of Bitcoin, and applications of blockchain technology in general, defies summary (and the full extend remains to be seen).
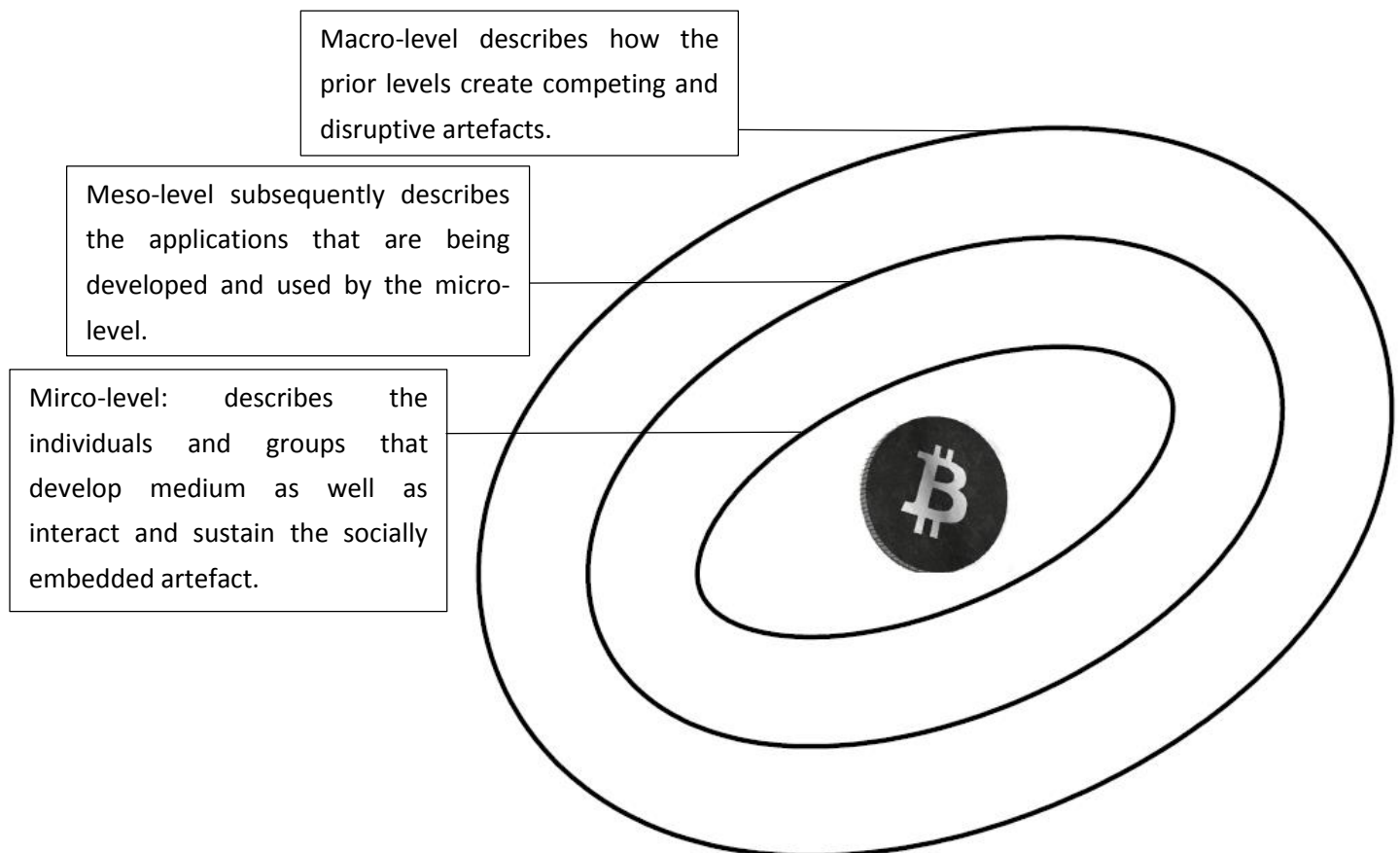
Through chapter three, it is shown how Bitcoin indeed can be understood as a medium, confirming a base assumption of this thesis. It is shown how McLuhan's (1964) liberal - and Irving's (1997) more delimited technology definition – is easily reflected in the understanding of Bitcoin, derived from chapter two. Additionally, from McLuhan's definition of money it can asserted that monies and media technology can be considered the same class of socially constructed and dependent artefacts. As these have no value unless a group or at least two individuals are willing to socially interact with them as a means of communication. Another definition is presented, Bitcoin is a medium, according to Lister et al. (2000), because it remediates, which is also highly reflected in Bitcoin. These are different and not mutually exclusive definitions, each providing a certain perspective that have merit in understanding the phenomenon. Bitcoin as a medium might easily be defined as belonging to a certain classification of technology, interactive digital media, or a type of new media. This designation is characterized by the medium's ability to allow the user to influence the mediated communication's form and content. Together with the open source development of Bitcoin, this only enhances the McLuhanite definition of media (and money as media). In regards to remediation, it might not be considered a property or quality specific to Bitcoin, as this is inherent to all media technology. However, the open source, egalitarian philosophy by which Bitcoin is created and is coded into the protocol, significantly promotes this quality and characteristic of Bitcoin.

The nature of Bitcoin has been established as virtual as it is represented in-material, while being intangible, yet has real material impact and value. The meaning of virtual, as a new type of artefact in itself, which appears to describe this haptic inconceivability of software, appears to be an applicable designation of the nature of Bitcoin. Due to the virtual, thus informational nature of the protocol, which exists in an open source developmental space that makes it very susceptible to remediation, both upon itself and of itself. While these qualities and properties all seem to overlap, enhance or be descriptors of one another, a simple way of defining Bitcoin into a continuum of media technology might be to adhere to Jensen's (2006) categorizations, which fits well with these descriptions. As such, Bitcoin is a media technology of 3rd degree, which is designated as being interactive and digital in nature, and often incorporate (remediate) lower degrees of media forms in a digital manner, making them digitally reproduced.

The implications of this definition is discussed via media articulated complexity of Bitcoin, which is characterized by not only complex semantic relationships between the possible layers, but several user types, encoding and decoding information in unique socially and culturally anchored contexts. In this light, the author conclude this to be an important characteristic of Bitcoin, its hyperactive remediating quality. The media articulations serves the purpose of describing the many forms a virtual artefact such as Bitcoin might take or remediate into due to informational nature of code. In addition, although perhaps not conceptually accurate to the nature of a medium, the development environment around Bitcoin, perpetuates and promotes the production and proliferation of its representations.

The interactive and global boundary-transgressing digital nature Bitcoin enables and promotes interaction between users, ignoring limitations of time and space, cultural and political barriers. Interaactions which might not have been possible before. This gives the currency of Bitcoin, as well as all other mediums value. As such, it is considered an important quality, as the medium would not exist without such social interaction. From a new media perspective, the result of this is Bitcoin becoming a vehicle of globalization and shifting in geopolitical power structures, according to both McLuhan (1964) and Bolter and Grusin (2000).

Considering these properties and qualities of Bitcoin, the author has found it useful to utilize the ecosystem metaphor to define the phenomenon. This serves the purpose of describing the environment that is referred to as the Bitcoin space. After describing the likeness and applicability of the digital business ecosystem, the author concludes the chapter by operationalizing the idea behind the DETT framework by Henningsson and Hedmann (2013):

Macro-level describes how the prior levels create competing and disruptive artefacts.

Meso-level subsequently describes the applications that are being developed and used by the micro-level.

Mirco-level: describes the individuals and groups that develop medium as well as interact and sustain the socially embedded artefact.

Figur 3

In the optics of Fang (1997) and McLuhan (1964), Bitcoin can or should be defined by the social impact it has. The ecosystem model describes how this might happen from the qualities and properties of Bitcoin at its center. While Bitcoin is seen as causative in the emergence of the ecosystem, the author postulates its initial

inception is more in line with Fang's perpective. According to Fang, a need and drive for social change enter into a relationship with these new technologies (which Bitcoin consists of) and create the information revolutions in an interrelated continuum. From this perspective, Bitcoin conceptualized in an environment characterized by social unrest and dissatisfaction with the status quo of financial institutions.

Common for Lister et al. (2000), Fang's (1997) historical perspective and the media theory framework of McLuhan (1964) is a mega trend towards decentralization, which is recognized as the McLuhanite ideal of the global village. The information age sees a general decentralizing mega trend in human affairs, which Bitcoin through its qualities is seen to accelerate. Bitcoin is not only decentralized in its distributed infrastructure, it is also a vehicle of decentralization of society, as it transgresses geopolitical and economic boundaries, creating novel opportunity for interaction. The author understands McLuhan's ideal of the global village as a product of this and asserts that Bitcoin furthers this ideal. As such, Bitcoin rivals and attempts to remediate conventional financial institutions and systems for the transfer of value in a world that is becoming more and more decentralized.

In considering whether or not Bitcoin constitutes a 7th information revolution, the phenomenon at large is easily reflected onto the commonalities of all prior revolutions. Certainly in regards to decentralization. Against that background, it does appear to be a new medium with significant social implications and global impact. In time this will become clearer. However, from the author's perspective, the phenomenon of Bitcoin and the remediations, which holds strong cultural ties to Bitcoin, does constitute a 7th information revolution.

The Bitcoin medium – and its impact - will ultimately be what its open source community of users want it to be, empowered by Bitcoin as a highly democratically developed, virtual artefact. "The message of the medium" is what its users seek to use it for at what Antonopoulos (2015) refers to as the edge. The scale of change and impact introduced into human affairs, will be reflected by this.

Practical product

Addressing the goal statement of the practical product, research question no. 5 defines the approach; how might answering these research questions contribute to more public awareness and understanding in regards to the Bitcoin phenomenon?

The concluded product of this might be considered two-fold. For the purpose of promoting the produced knowledge, the author created an information product on a Wordpress platform. As such, the practical product resides on the domain name: www.bitcoin-research.com. However, to further improve and define the definition and perspectives produced herein, the author aims to treat the practical product as a case study, utilizing common-based peer production principles. A Screen capture of the web site is seen below:

Bitcoin Research

A collaborative exploration
of the Bitcoin phenomenon
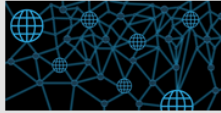
🔍 Search

Edit

About

Hello,

My name is Thor Larsen and I am currently writing my Master's thesis in Interactive Digital Media at Aalborg University, Denmark.

The Master's degree is based in the realm of new media and the way in which they enable interactivity and thereby creates new relationships and experiences for users, on the individual as well as cultural plane. As such, the subject area are interactive digital media and their theoretical foundation, as well as their production, distribution, use and meaning.

As a short introduction to the area of concern of my thesis, Bitcoin is perceived as a whole, a phenomenon. Bitcoin has an enormous body of research from Law, economics and computer science. However, the social sciences are largely lacking and a general overview and definition of Bitcoin, as a socially disruptive phenomenon, is largely absent.

This site is being build alongside the development of my Master's thesis with the goal of both giving back to the community, while also receiving feedback on the subject of the Bitcoin phenomenon. I aim to create my master thesis about an open-source, collaborative phenomenon, in an collaborative manner. This is an attempt to empirically involve the community into an otherwise mostly theoretic framework. The intended result of this method is a more involved, community-driven depiction of the Bitcoin phenomenon. In addition, a goal statement of the thesis is to create a practical information product, which will be the final stage of this site.

This site will be slowly populated with the sections of my thesis and as part of my process, I urge you to give feedback, discuss and share, if you find the information interesting. More importantly, if you discover inconsistencies, errors, or just plain nonsense, I urge you to give me a piece of your mind and help me create a better, final text for my thesis and the community at large, which I hope will benefit from my work. As English is not my native language, I assume there will be numerous significant errors that I invite you to rectify!

I hope you enjoy.

Leave a Reply

BIBLIOGRAPHY

Antonopoulos, A. (2013). *The crypto-currency ecosystem: A taxonomy of alt-coins, meta-coins and blockchain-riders.* Retrieved 02/28, 2015, from http://radar.oreilly.com/2013/06/the-crypto-currency-ecosystem.html

Antonopoulos, A. (2015). Bitcoin: Dumb networks, innovation and the festival of the commons. *Bitcoin and the Blockchain,* San Francisco, SA.

Bandara, H. M. N. D., & Jayasumana, P. (2013). Collaborative applications over peer-to-peer systems - challenges and solutions. *Peer-to-Peer Networking and Applications, 6*(3), 257.

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report, 13*(4), 544.

Bergstra, J. A., & de Leeuw, K. (2013). *Bitcoin and beyond: Exclusively informational monies*. Amsterdam: University of Amsterdam.

Bhaskar, R. (1978). *A realist theory of science*. Brighton, Sussex: Harvester Press.

Bitcoin.it. Retrieved 01/05, 2015, from https://en.bitcoin.it/wiki/Satoshi_Nakamoto

Böhme, R., Christin, N., Edelman, B., & Moore, T. (2014). *Bitcoin*. Boston, MA: Harvard Business School.

Bolter, J. D., & Grusin, R. (2000). *Remediation: Understanding new media*. Cambridge, MA: The MIT Press.

Bourdieu, P., & Wacquant, L. J. D. (1996). *Refleksiv sociologi: Mål og midler* (1st ed.). Copenhagen: Hans Reitzel.

Bowler, G. M. (2010). Netnography: A method specifically designed to study cultures and communities online. *The Qualitative Report, 15*(5), 1270.

Brautigan, R. (1967). *All watched over by machines of loving grace* (1st ed.). San Francisco, California: The Communication Company.

Buch-Hansen, H., & Nielsen, P. (2012). *Kritisk realisme* Samfundslitteratur Roskilde Universitetsforlag.

Chi-Hyon, L. N., Venkatraman, H. T., & Bala, I. (2010). Complementarity-based hyper competition in the software Industry: Theory and empirical test. *Strategic Management Journal,*

Dini, P., Rathbone, N., Vidal, M., Hernandez, P., Ferronato, P., Briscoe, G., et al. (2005). *The digital ecosystems research vision: 2010 and beyond* European Commission.

Dockterman, E. (2013, December 10, 2013). JPMorgan may create a virtual currency that rivals bitcocin. *Time,*

Driveshare. (2015). Retrieved 11/04, 2014, from http://driveshare.org/

Fang, I. (1997). *A history of mass communication: Six information revolution*. Newton, MA: Focal Press.

Ferguson, N. (2008). *The ascent of money: A financial history of the world*. London: The Penguin Press HC.

Finnemann, N. O. (2005). *Internettet i mediehistorisk perspektiv*. Frederiksberg: Samfundslitteratur.

Genosko, G. (1999). *McLuhan and Baudrillard: The masters of implosion*. London: Routledge.

Gillman, M. I., & Hails, R. (1997). *An introduction to ecological modelling: Putting practice into theory*. Oxford: Wiley-Blackwell.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research paradigms. In N. K. Denzin, & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105 - 117). CA: Sage.

Hall, S. (1973). Encoding and decoding in television discourse. *Culture, Media, Language: Working Papers in Cultural Studies,*

Hedman, J., & Henningsson, S. (2013). Transformation of digital ecosystems: The case of digital payments. *Information and communication technology* () Springer Berlin Heidelberg.

Hern, A. (2014). *It's bobsleigh time: Jamaican team raises $25,000 in dogecoin.* Retrieved 11/02, 2014, from http://www.theguardian.com/technology/2014/jan/20/jamaican-bobsled-team-raises-dogecoin-winter-olympics

Holdgaard, L. (2014). *An exploration of the bitcoin ecosystem*. Copenhagen: Copenhagen Business Institute.

Jansen, M. (2013). The political 'virtual' of an intagible material currency. *Internation Journal of Community Currency Research, No. 17*

Jensen, J. F. (1997). Interaktivitet - på sporet of et nyt begreb i medie- og kommunikationsvidenskaberne. *Mediakultur, 26*

Johari, K., & Kaur, A. (2011). Effect of software evolution on software metrics: An open source case study. *ACM SIGISOFT Software Engineering Notes, 36*(5)

Jones, P., & Holmes, D. (2011). *Key concepts in media and communications*. London: Sage Publications.

Kant, E. (1770). *On the form and principles of the sensible and intelligible world*

Kelty, C. M. (2008). *Two bits: The cultural significance of free software*. Durham, London: Duke University Press.

Kozinets, V. R. (2010). *Netnography: Doing ethnographic research online*. London: SAGE Publications.

Krohn-Grimberghe, A., & Sorge, C. (2013). *Practical aspects of the bitcoin system*. Paderborn, Germany: University of Paderborn.

Leadsom, A. (2015). *Digital currencies: Response to the call for information* (Budget. London: HM Treasury.

Lister, M., Dovey, J., Giddings, S., Grant, I., & Kelly, K. (2009). *New media: A critical introduction* (Second Edition ed.). New York: Routledge.

Litecoin. (2015). Retrieved 02/05, 2015, from https://litecoin.org/

Mathiassen, L., Chiasson, M., & Germonprez, M. (2012). Style composition in action research publication. *MIS Quarterly, 36*(2)

McLuhan, M. (1962). *The gutenberg galaxy: The making of typographic man*. Toronto: University of Toronto Press.

McLuhan, M. (1964). In Gordon W. T. (Ed.), *Understanding media: The extensions of man*. Berkeley, California: Gingko Press.

Mills, R. (2011). Researching social news - is reddit.com a mouthpiece for the 'hive mind', or a collective intelligence approach to information overload. *Ethicomp 2011,* Sheffield.

Moore, G. (1998). Cramming more components onto integrated circuits. [Cramming More Components onto Integrated Circuits] *Proceedings of the IEEE, 86*(1), 82.

Moore, J. F. (1996). *The death of competition: Leadership & strategy in the age of business ecosystems*. New York: HarperBusiness.

Nakamoto, S. (2008). *Bitcoin: A peer-to-peer electronic cash system.* Unpublished manuscript.

Nygaard, C. (2012). *Samfundsvidenskabelige analysemetoder* Samfundslitteratur.

Phenomenon. (2015). Retrieved 02/15, 2015, from https://en.wikipedia.org/wiki/Phenomenon

Piaget, J. (1999). *The construction of reality in the child*. Abingdon, Oxon: Routledge.

Schaefer, M. T. (2011). *Bastard culture!: How user participation transforms cultural production*. Amsterdam: Amsterdam University Press.

Selander, L., Henfridsson, O., & Svahn, F. (2010). Transforming ecosystem relationships in digital innovation. *31st International Conference on Information Systems,*St. Louis. *, 31.*

Silverstone, R., & Haddon, L. (1998). Design and the domestication of information and communication technologies: Technical change and everyday life. *Communication by design: The politics of information and communications technologies* () Oxford University Press.

Simonite, T. (2013). Mapping the bitcoin economy could reveal users' identities. *MIT Technology Review,*

Storj. (2015). Retrieved 11/02, 2014, from http://storj.io/

Villasenor, J. (2014). *Secure bitcoin storage: A Q&A with three bitcoin company CEOs.* Retrieved 12/02, 2014, from http://www.forbes.com/sites/johnvillasenor/2014/04/26/secure-bitcoin-storage-a-qa-with-three-bitcoin-company-ceos/

Wad, P. (2006). Komparation i kritisk realistisk perspektiv. *Dansk Sociologi, 11*(3), 7.

Wallas, G. (1970). *The art of thought* Penguin.

Wan, T., & Hoblitzell, M. (2014). *Bitcoin: Fact. fiction. future* Deloitte University Press.

Weiser, M. (1999). The origins of ubiquitous computing research at PARC in the late 1980s. *IBM Systems Journal, 38*(4)

Winnicott, D. W. (2002). *Leg og virkelighed* (2nd ed.). Copenhagen: Hans Reitzel.

Wordpress.com/about/. Retrieved 10/09, 2015, from https://wordpress.com/about/

Yu, D., Hang, C., & Chang, C. (2009). A reflective review of disruptive innovation theory. *International Journal of Management Reviews,*

APPENDIX

Appendix 1 – General creative method and eclectic approach

To solve a problem, a solution must be provided by means of creative process. In the following the idea of the creative process will be elucidated. This is done with the purpose of shedding light on the creative process that has been adopted and drives the development of this thesis. The creative method is not applied to either one of the products of this thesis. Rather, it is applied universally onto to all aspects of this undertaking, the process and the products, as a means of describing the thought process behind addressing the overarching research question.

In the 20th century Graham Wallas (1926) pointed to the existence of four generic stages contained in the creative process: preparation, incubation, illumination, and verification. This process is depicted as such:
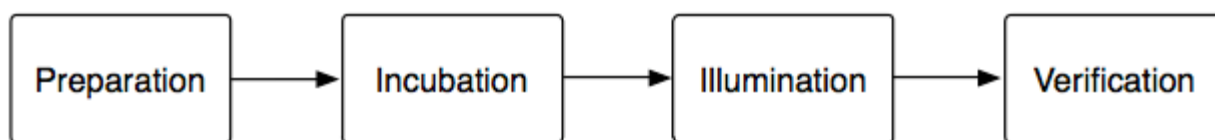
Problem formulation characterizes the first phase, 'preparation'. This phase consists of defining various needs and requirements, information gathering and evaluation. In case of the present text, this phase is concluded by the research questions outlined in the introduction section, which is produced mainly by auto ethnographic means.

However, Vanosmael and De Brun (1990) add another layer to this phase, "frustration", which is characterized by a surge in "emotional energy" stemming from the frustration in regards to the problem in question. This energy is defined as unconscious driving the development of possible solutions, which very much has defined the initial process in the writing of present text and furthermore, deciding on thesis topic. In a chronological perspective, this phase is seen as the first chapter.

Following the preparation phase, a need to detach from the frustration characterized hereby, the 'incubation' phase happens. This phase is defined by a distancing to the problem and its frustrations, from initially being intensively saturated by it, which allows the mind to contemplate upon it in a larger context. Largely, within the confines of this thesis, this phase can be described, implicit as the temporal void that is experienced by the author between defined problem statements and the selection and decision-making in regards to primary and secondary theory and literature, yet not visible distinguished in the actual text.

Incubation is then superseded by the 'illumination' phase, which is associated with an onset of ideas and provides the basis of creative response. Unlike the other phases, 'illumination' is often brief and defined by

a rush of insights into the matter at hand. In the context of present text, this creative response phase is characterized by an eclectic approach, due to the assumption that this concept articulates the foundation of scientific description, by recognizing: "the development of the scientific description and understanding of a specific object cannot exist in a developmental vacuum (…)". Towards defining the Bitcoin phenomenon, eclecticism is what characterizes inter-theoretical and academic relations, which develop scientific understanding by relating objects and properties of these objects (Køppe, 2011, 1-2). Thus, present text recognizes the philosophical need to be creative in regards to developing a theoretical framework. Yet, this creativity must be limited to theories that describe and define the empirical object (Køppe, 2011, 13). The chosen theories and perspectives is based upon preliminary ideas and understanding, which seems to signify the phenomenon, within the given context.
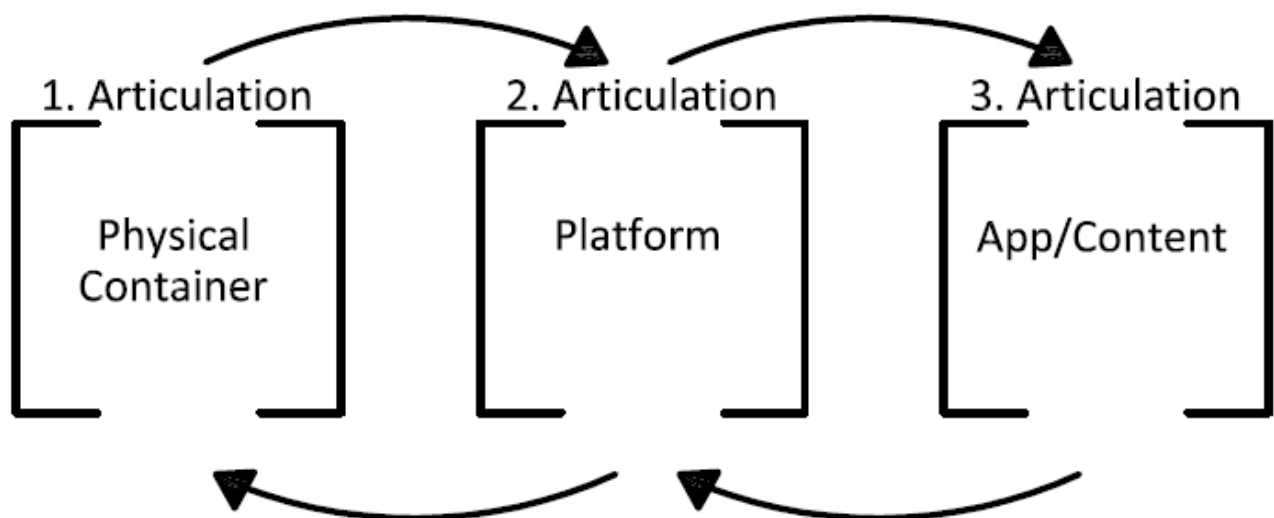
Following 'illumination phase, 'verification' is the stage, which assesses the obtained results and solution in relation to the initial problem statement, defined in the 'preparation' stage. Vanosmael and de Brun (1990) add that this phase might not only serve as a final conclusion, but also create basis for a more fundamental change of vision. In modern academics, this has become a standard condition when defining a problem statement, with the goal of challenging current or creating new knowledge. Present text believes there is far-reaching, paradigm-shifting potential in the phenomenon at large, meaning that the product of the verification phase is aimed towards exactly this. That is, creating base knowledge from which to further study more delimited and specific areas of concern. In summary, the author believes that one such problem that might advantageously be subject to the creative process is how to understand and define the Bitcoin phenomenon.

Appendix 2 - Operationalizing Media Articulations

Based on the understanding thus far, derived through the preceding chapters, the author will attempt to create representative examples of the ways in which it creates meaning through and is represented through interactive digital media. Media articulations provides a framework to comprehend the various semantic layers of the medium from different (user) perspectives.

Adapted Media Articulations

Expanding on the concept of media as being double articulated, the author considers a popular media framework to distinguish between these levels on digital media is proposed and used by Finnemann (2005) and Haddon & Silverstone (1998): the meanings of a media technology is to be understood by three elements. First, the technology: as the physical object or container. Secondly, platform: as the software, which runs on the physical container. Thirdly, the content: as the digital, encoded message, allowed by the software. Although these articulations describe separate levels, they are still considered interdepended. Similarly, Bitcoin as medium and content is seen as inseparable, thus interdependent. This relationship is depicted in the following model:

A preliminary application of this model to describe the Bitcoin medium would place a smartphone as the physical container, android as an operative system on which to run a wallet app, through which the block chain would be represented as the content. While this text has an obvious focus on the third articulation in this model, all articulations hold semantic value in defining the medium, as it is represented through meaning derived on the basis of all three. In addition, the versatility of this model begs an adaptation to the specific medium in question. By second glance, in describing the relationships between the articulations of Bitcoin, issues arise with this model. Abstracting to the utmost articulation of Bitcoin, first articulation, it becomes a matter of perspective, which is unique to the individual user.

User perspectives

Ordinary users of Bitcoin might be more familiar with the various wallet apps, which can be used on a variety of containers, such as smartphones, tablets and laptops. In the other end of the user spectrum, a developer, within the open source and API characterized community, might work on another (binary) level of abstract semiotic production, creating the front end of a new representations of the protocol. It might be safe to assume such users would also be interesting in running miner software to sustain the network to which they are creating applications. Because the contexts in which the artefact is being encoded and decoded have an impact on how the content is understood are countless, two archetypes contexts, representing two types of users, will be chosen.

Assuming the ordinary wallet app user is the most abundant and will base a majority of this discussion on this. These individuals use the medium primarily as a means of exchange, which presumably is the predominant use of the medium as more and more vendors become available. These users utilize the wallet apps on a variety containers, with a subset of second articulation platforms. These containers can be smartphones, tablets, laptops and stationary computers. Generally, the first articulation is rather unproblematic to define, as it will always be a computer technology. Second articulation, however, presents itself in numerous ways, and to a large degree is dependent on the container technology. Second articulation is embedded into the technology container. As a result, the specifications of the computer technologies mentioned determines to a large degree which platform or operative system is available. These operative systems or platforms might be as follows: linux-distributed operative systems, Android, Apple systems and Windows systems.

Instead of abstracting to the utmost level of the medium (the physical container), making it the first articulation, the author proposes to invert this perspective, making the immaterial, digital content the starting point and from there abstracting outwards. By its distributed nature the block chain exists very independently of the container and the platform. As a result, by inverting the abstraction process, it becomes easier to describe in which ways the content is represented or remediated. The model still serves the same purpose, the focus has simply been shifted from the container to the content as point of origin.

First iteration

Mapping which operative systems run on which technologies is not the concern here. Acknowledging the intrinsic complexity of possible relations between these levels of articulations is the main concern, and as such, the need for a fourth articulation presents itself. As the block chain, the content, is the first articulation in the proposed inverted media articulation model, the application, which resides on the platform, requires its own articulation. As these apps are numerous and bound to the operative system, they represent an additional level in the relationship, which describes the medium in its entirety. Based on perspective of the

presumed most abundant user type and one additional level of articulation, first iteration of the Bitcoin adapted articulation model looks as such:
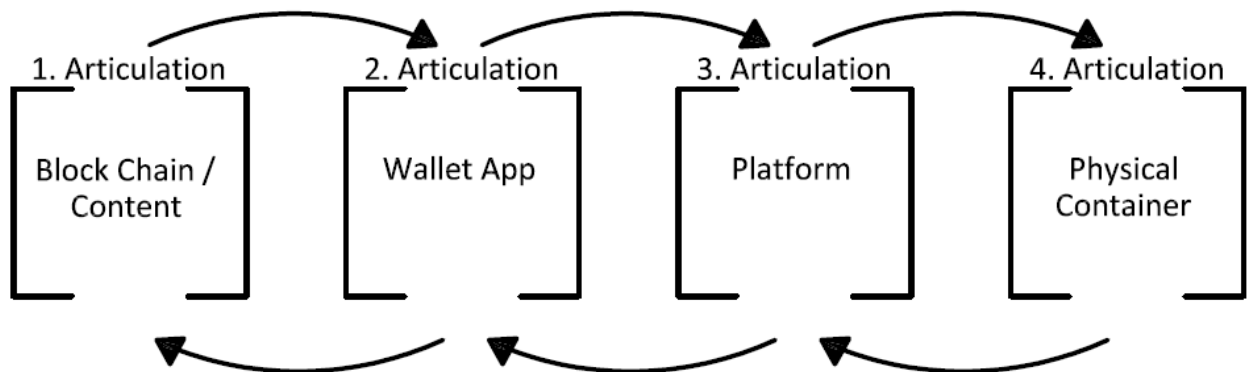
As such, the networked characteristic of Bitcoin creates another meaningful level, in this model designated as the block chain (the content). The block chain is the first articulation. Second articulation however, allows interfacing with the block chain, making it the second articulation. Third articulation is the platform onto which the second articulation runs. Fourth articulation is the container. Introducing the block chain as the originating point and allowing the following articulations to emerge from this point is useful from two perspectives. In addition, as will be seen shortly, the user perspective layer also become applicable with this articulation structure. As such, the articulations are seen as emerging from the content, the message, block chain, anchored in a certain social and cultural context.

Second iteration

Due to the networked nature of Bitcoin, the block chain is being represented through a host of different apps, platforms and containers. The model can be expanded further, as of now it only shows loosely coupled concepts to describe the levels. In a further development of this model, the various representations of the levels can be described:
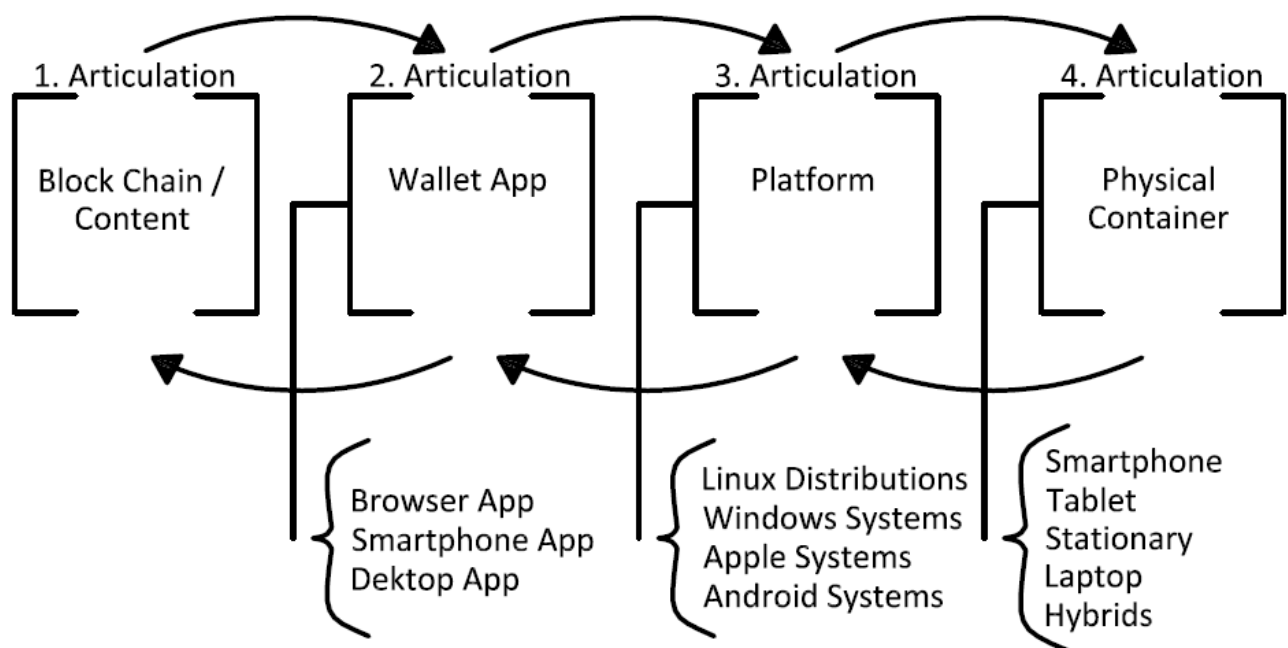
This iteration attempts to exemplify the variety of representations each articulation covers by making the loosely coupled concepts more concrete. As such, the curly brackets show some examples of possible manifestations of each articulation. Discussing the various brands and their qualities warrants significant market research and is not rewarding towards the goal of creating a framework in which to understand the significance of different meanings of the Bitcoin medium. However, the properties of the different variations of the articulations serves to show the possible complex network of semantic relations. As such, the curly brackets of the second articulation exemplifies several manifestations of the represented concept, wallet app.

- Mobile App. This version usually resides on mobile container technologies and most times come with a QR-code to easily mediate the transactional information (the receiving Bitcoin address) between the two actors in a face-to-face situation.
- Wallet app. This type is a stand-alone app, installed directly into the platform.
- Browser App. In and by itself this begs an additional articulated level, as this app is anchored in a browser, which represents another sign system and semantic deriving layer.

These serve different purposes derived from the context in which they are used. The app articulations enter into complex relations with the platform and container articulated examples to produce a number of quadruple articulated semantic outcomes with the different properties and qualities. Of course, not all combinations exist due to hardware and manufacture restrictions, as both container and platform has articulations determine to a large degree which apps are allowed to be installed. As such, the combination of a windows platform and an apple app, will not articulate into an existing medium, demonstrating the

inherent weakness of the inverted model. Apart from this fault, the model can be used to describe the numerous media articulation combinations possible with mobile container technologies. The combination
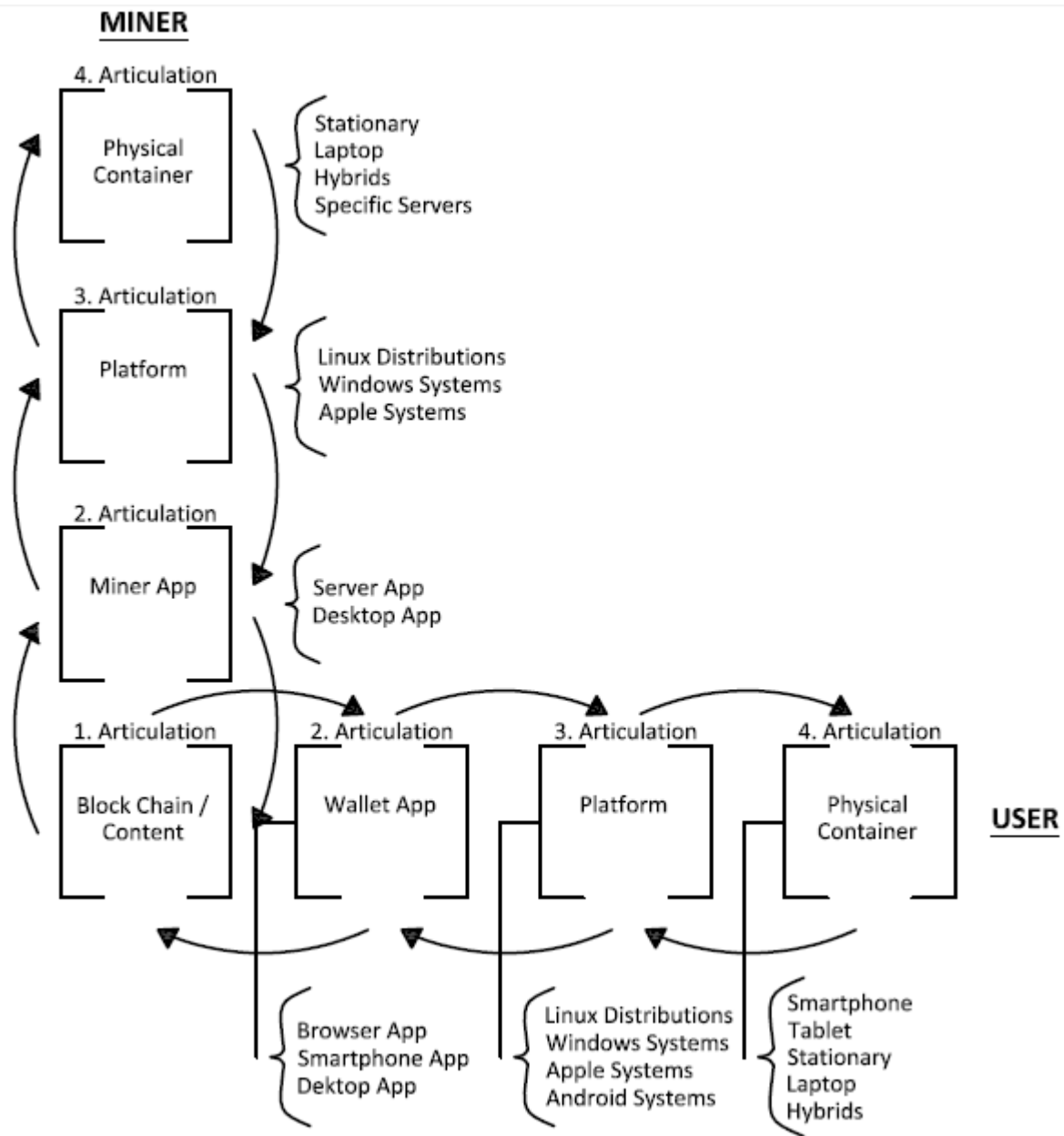

which appears most numerous is exemplified by the android platform, which is mostly utilized on mobile computer containers.

The above image is the result from searching for "Bitcoin wallet" in the android app store. These icons each represent different experiences and qualities at the edge of the protocol, where users interact with the medium through a certain set of semantic layers.

Third iteration

Evidently, the first articulation of this model depends on, and becomes important only because of the distributed and networked nature of the protocol, as it require an internet connection to interface with the block chain, the content. In turn, the block chain must reside on its own set of articulated levels, as it is merely represented to the wallet app by a networked technology. Of course, this represents a differing user perspective, as the nodes in the Bitcoin network, referred to as miner clients, are run by more technical users in the network. These user types will be referred to as their role in the network, miners. These users, the second archetype of users, however, by result of the immaterial labor, also hold wallets to keep their store of work-derived coins. To accommodate both major archetypes perspectives (user types), the next iteration take shape as such:

MINER

4. Articulation
Physical Container

Stationary
Laptop
Hybrids
Specific Servers

3. Articulation
Platform

Linux Distributions
Windows Systems
Apple Systems

2. Articulation
Miner App

Server App
Desktop App

1. Articulation
Block Chain / Content

2. Articulation
Wallet App

3. Articulation
Platform

4. Articulation
Physical Container

USER

Browser App
Smartphone App
Dektop App

Linux Distributions
Windows Systems
Apple Systems
Android Systems

Smartphone
Tablet
Stationary
Laptop
Hybrids

The final iteration of the adapted media articulation model shows how meaning is created through the semantic layers, which goes into representing the Bitcoin protocol from two differing archetype user perspectives. The miner user, represented by the vertically emerging articulations, while the ordinary user represented by the horizontal. In this manner, the model attempts to approximate very broad definitions of encoding and decoding contexts, which influence how the content of the medium is understood. At the same time, sustainability of the network is dependent on the miner type user and the immaterial labor put forth by these actors in the network. As such, the twin structure of the model shows the media articulated complexity of Bitcoin, which is characterized by not only complex semantic relationships between the possible layers, but several users types, encoding and decoding information in unique socially and culturally

anchored contexts. In this light, the author considers an important characteristic of Bitcoin to be its hyperactive remediating quality.

Appendix 3 — Reddit and ethnographical principles

Robert V. Kozinets (2010), anthropologist and Professor of Marketing at York University's Schulich School of Business, provides a six stages methodological approach in his computer-mediated communications-adapted derivative of ethnography, netnography. Starting from defining a research plan, entrée, data collection, analysis and interpretation, ensuring ethical standards and representing the research. However, only key stages will be adapted and subsequently only selected principles of the chosen stages. A complete adherence to the netnograpgical approach would be far too cumbersome and even disadvantageous to the scope of this enterprise.

While doing actual ethnographic research is not the goal, adapting key steps within the proposed methodological approach appears to create an advantageous synergy with peer production. As such, distinct stages of Kozinets' (2010) netnography will be applied:

- Community identification and selection
- Principles of 'entrée' and data collection
- Ethical considerations

While the text understands that these principles are not unique to Kozinets interpretation of ethnography, they are easy applicable and adaptable concepts. Items such as research planning and research representation is done quite independent of netnography, while data collection and data analysis will be conducted in a far more informal manner, than netnography would agree with, as it otherwise would become too cumbersome an undertaking. A more obvious rationale to depart from netnographical methods, in regards to actual data collection and analysis, would be the dissociation with studying cultural relations as opposed to simply enter the community in an ethical manner and seeking peer produced feedback and affirmation.

Reddit platform & Community

According to Kozinets (2010), familiarization with relevant communities for collecting data is second step in entrée (p. 79). As such, the chosen community and platform is that of reddit.com. The researcher is beforehand familiarized with this community to a large extend. While an analysis of this social platform (or the relation between the platform and community) is beyond the scope, providing an introductory overview (which admittedly is of an old date, yet still accurate) of the nature of this platform, social news researcher R. Mills (2011) describes it as such:

> *"Reddit utilizes a bi-directional voting system where users and up-vote or down-vote*
> *items to increase or decrease their score. An item's score, coupled with a time penalty*
> *for older votes, is used to determine the prominence with which the item will be*

displayed. There are two types of primary units of content (posts) on reddit; link post and text posts. Link posts are comprised of a title and a hyper-link to some URL: while text posts consist of a title and a body of text entered directly on reddit by the submitting user." (p. 3)

It is important to note that the text post type also can contain hyper-links. In the author's experience, this is often used because it allows the poster to add context and meta-text to the link, providing the reader with more information. The text aims to do just this, by providing basic information pertaining to the project, including a hyper-link to the Wordpress publishing platform, located at www.bitcoin-research.com. The context or meta-text will provide the reader with a basic understanding of the project, its aim and more importantly the methodology, which includes informed consent.

The voting system of Reddit is referred to as distributed moderation. According to Mills (2011), distributed moderation is a user-driven approach to information overload and relates strongly to the aforementioned phenomenon of peer production. It relies on user activity determining an item's, importance, quality or relevance, which make said items more or less visible accordingly (p. 1). In relation to Reddit, this not only relates to the to the individuals posts, but also to the comments by users to that post. In addition, comments to comments are also subject to the same voting system, the result of which is an emerging, democratically mediated discourse. Users can make their opinions known by simply up-voting existing comments or posts. As such, the distributed moderation structure of Reddit works in favor of the applied peer production phenomenon, by aiding in the consensus creation. The result of this being the text may be able to gauge consensus by considering the up- or down-vote score of items. However, it might also be the case that the post itself might be down-voted and thereby gain less exposure to potential peer contributors. The risk of this happening seems outweighed by the potential gain, considering this is a very experimental approach and considered a complementary addition to the theoretical whole of this thesis.

The reddit platform is categorized into sections or sub-forums. According to Mills (2011), these are referred to as 'sub-reddits' and any user (or non-user) can navigate to them, although some sub-reddits may require certain privileges for users to post and/or comment on posts. The vast majority of sub-reddits are player created and governed. Users may subscribe to sub-reddits, which they follow or take special interest in (p. 3-4). On the matter of identifying and selecting an online community, Kozinets (2010) suggests utilizing a number of variables. Such important characteristics of communities are: relevance, activity, interactivity, substantiality, heterogeneity and data-richness (p. 89). The text has chosen the general sub-reddit concerned with a variety of aspects pertaining to Bitcoin, located at www.bitcoin.com/r/bitcoin, hereafter referred to as /r/bitcoin. It appears to be the most relevant sub-reddit for the topic of this thesis and at a glance appears to have a fair amount of heterogeneity and the interactivity of the platform has already been touched upon. At the time of writing, /r/bitcoin has 154.979 users subscribed (with an increase of 200-300 per day), approximately 200.000 page views per day, all of which can be considered indicative of high activity,

substantiality and data richness. As such, /r/bitcoin appears a satisfactory candidate for ethnographic enquiry in the framework of Kozinets (2010). The below screen captures provides additional details:
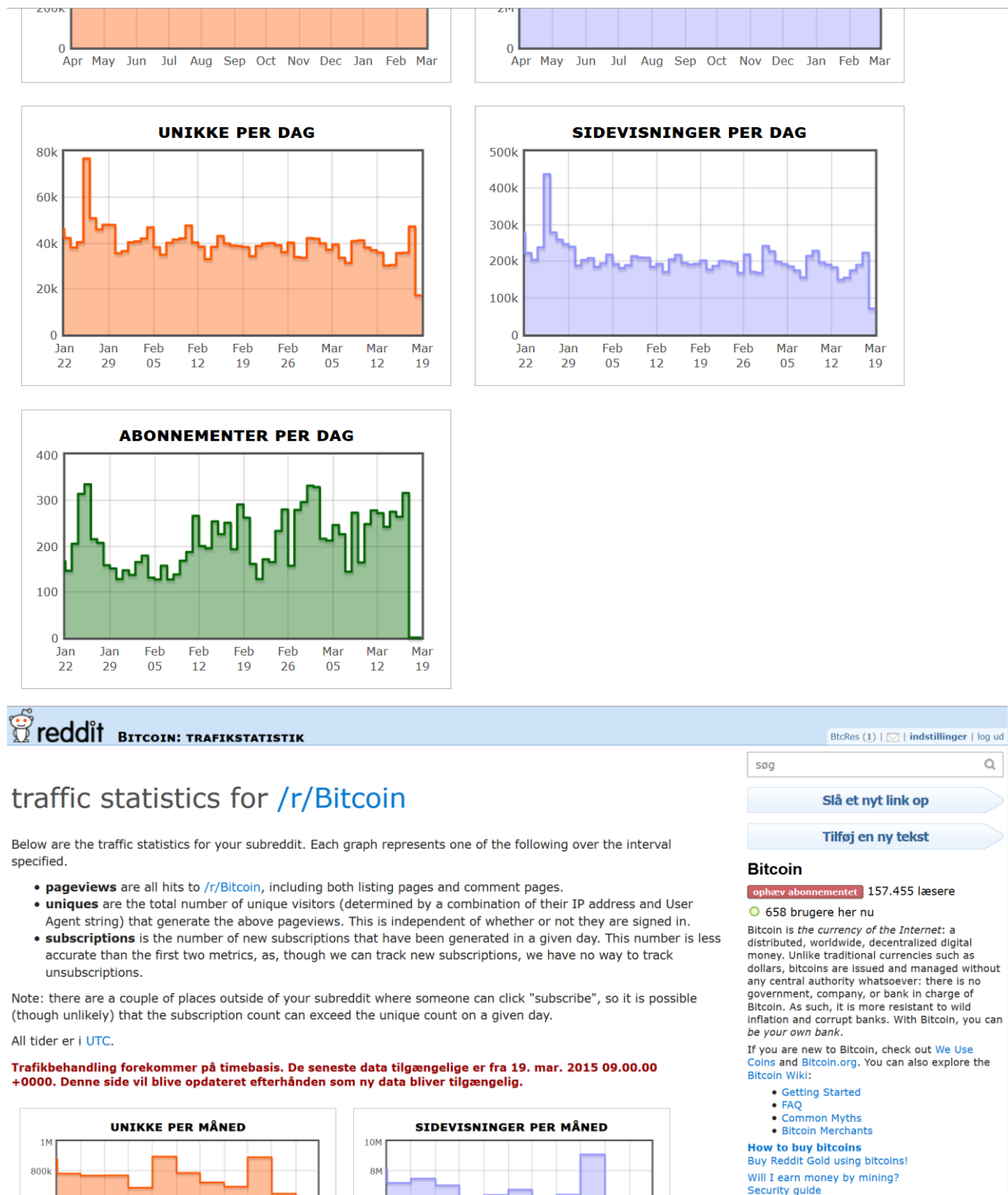
/r/bitcoin is chosen not exclusively due to its a large pool of users, but because the phenomenon of Bitcoin and particular Bitcoin technology is yet such a novel inception that literacies are not commonplace, meaning that the individuals of this community might represent one the largest, most accessible pools of Bitcoin interested individuals or agents. The choice of the Reddit platform, however, is justified by its superior distributed moderation structure, promoting peer production consensus.

Entrée and data collection

Identifying self and purpose are important steps according to Kozinets (2010). In light of this, the author created a user account on Reddit specifically to identify with this enterprise, called "BtcRes". Furthermore, the purpose will be clearly stated, in a short version, while hyper-linking to more thorough text, stating the purpose and intent of the posts on the Wordpress publishing site. Although the Reddit platform is anonymous and does not require identity authentication, the researcher will state real name and intent in the post in an attempt to garner more credibility (name will also be stated on the Wordpress publishing site).

Principles of entrée compels the researcher to engage, immerse and contribute to the community as a member, as opposed to a researcher (Kozinets, 2010). The text contributes in the same act as it seeks peer contributors, as material is published at the same time as feedback is requested. In addition, present researcher engaged and made himself useful to other members of the community, by contributing to answering questions, prior to posting any section of the thesis. The aspect of immersion is undoubtedly more important in real ethnographic studies, as it pertains to understanding the culture. It bears mentioning, however, the researcher is already familiar with this platform and its community, and considers himself deeply immersed.

In the framework of Kozinets' (2010) netnography, the act of data collection is interconnected with ethnographic participation (p. 96), which means that the researcher should be actively engaged with and visible to the community. In regards to the Reddit platform there an abundance of opportunity for participation, as this extends to posting links or text, commenting, up- or down-voting or sending private messages. Kozinets (2010) suggests two basics methods of this. Saving the data as computer-readable files or simply capturing the data in its entirety as visual images of the screen (screen shots) (p. 99). Due to the high interactive and participatory nature of the Reddit platform, the text believes the latter option to be superior. In this manner, both the distributed moderation mechanics and the text is captured in its structured framework and not separated.

In collecting data, Kozinets (2010) describes three different types of which the text will focus specifically on elicit data. This type of data is generated from the interactions between researcher and community members in a personal or communal manner. Elicit data is the co-created value generated in the tension between the researcher and the community dynamically (p. 98), and therefor can be contextualized in specific discourse as it pertains to the peer production feedback mechanisms.