

“Hey, I know what this is!”: Cultural Affinities and Early-Stage Appropriation of the Emerging Bitcoin Technology

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ABSTRACT

User appropriation can be immensely helpful to bootstrap emerging technologies; but how do new and lesser known technologies attract these earliest adopters? This paper investigates user appropriation of emerging computing technologies, by focusing on Bitcoin, a digital monetary system supported by a peer-to-peer network of computing devices. We conducted in-depth interviews with sixteen Bitcoin community participants in Hong Kong, Singapore, and Baltimore. We describe user appropriation in this case of Bitcoin as a sociocultural journey—from encounter, research and learning, to socialization. We contribute the concept of *cultural affinities*, including conceptual, contextual and social dimensions, as important mediators leading to early-stage user appropriation.

CCS Concepts

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Keywords

Appropriation; bitcoin; sociocultural.

1. INTRODUCTION

User appropriation of innovation by communities can help bootstrap emerging technologies [16]. However, emerging technologies are by definition promising but yet to be proven; so why would some users choose to contribute their time and effort supporting their development? In HCI, the appropriation literature has largely focused on examining personalization and reuse of matured technologies (e.g., mobile apps and web tools) [3,6,13,27,29,33], but not emerging tools. Likewise, the technology adoption and online community literature has only examined cognitive and relational factors motivating user contributions [7,16,28,31]. Importantly, we lack studies that examine *why people would choose to appropriate a relatively*

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unknown and obscure technology in the first place.

In this paper, we examine a particular instance of user appropriation in an emerging technology, Bitcoin—a digital monetary system first developed in 2009 by one or several pseudonymous creator(s) [25]. In many ways, a significant portion of early Bitcoin users represented a distinct group of appropriators who were motivated by narratives of techno-utopian vision [18,20,37]. But since 2013, financial technologists have begun to take interest in the technology underlying Bitcoin’s digital currency—an open ledger system, known as the “block chain,” which enables the exchange of digital tokens securely, with a potential to override the need to involve a counterparty (e.g., a broker and clearing house) in the trade settlement process. This promise of block chain technology to simplify the process of global financial trading is accompanied by recent involvement of new actors in the community, such as bankers, entrepreneurs, and financial institutions. The inclusion of these corporate actors is enriching and expanding a dynamic social environment, which just two years ago had consisted primarily of libertarians resisting technological institutions [18,20,37]. However, what is still unclear is the perspective of end users—how they got involved and became users and contributors.

This paper presents a study exploring end users’ perspectives, to understand how they have become involved with Bitcoin and contributed to its development. We performed open-ended interviews of early Bitcoin participants between September 2013 and February 2015. These interviews took place as part of an ethnographic study of Bitcoin communities in Hong Kong, Singapore, and Baltimore. We interviewed a total of 16 participants, most of whom were recruited from open Meetup groups (see Meetup.com). We asked questions related to how they got to know about Bitcoin and their personal opinions at the time of the interviews. All interviews were audio-recorded, transcribed, and analyzed for recurring themes.

We found that while our informants got to learn about Bitcoin in a variety of ways, they shared a common trajectory in the process of becoming active participants, though each individual’s own background knowledge in related interests may have led to different degrees of enthusiasm about the technology. With that understanding, we argue that appropriation needs to be explained beyond simple accounts of personalization and reuse, and rather as a continually developing enterprise. In this case of Bitcoin, a user may decide to develop an application or a business on the platform, expanding its sociotechnical infrastructure, thus blurring the line between a user and developer. We address this issue by adding an additional sociocultural frame to the appropriation concept—cultural affinities (consisting of contextual, conceptual,

and social dimensions)—to highlight how user participation in appropriating innovations is mediated not by their predesignated roles (i.e., being called a user or a developer), but by their ability to harness sociocultural resources which vary from person to person.

2. RELATED WORK

Below, we will review related work on user appropriation and user participation, and examine the research gap in the literature.

2.1 User Appropriation

User appropriation is the practice of users performing novel customization, or identifying new uses for technologies [8]. User appropriation is important to product design, for the practice enables customization of a product to users' individual needs [8]. In the case of devising new uses for a technology, user appropriation is also a social practice of transforming an instrumental tool into a status symbol and cultural standard of interaction [2,6], which may include collective appropriation and modification of community technologies for collaborative purposes [2].

The literature currently lacks research work examining *early-stage appropriation*, particularly of emerging technologies requiring significant shepherding in order to becoming useful to people and communities. Importantly, the user appropriation literature in HCI has generally focused on *post-development* practices of user appropriation [6,13,27,29,33]. These include developing technological practices [6,33], providing online help [13], information sharing [27], and leading the appropriation process [29]. In order to successfully examine these post-development practices, previous researchers have studied technologies that were well established; these included the iPhone [6], MythTV [13], a social networking site [27], a multimedia messaging service (MMS) [33], and a commercial learning management systems (LMS) [29]. Thus, a study of the Bitcoin context will help to fill a research gap on the topic of appropriation of emerging technologies.

2.2 User Participation in Citizen Science, Online Communities, and Adoption Theories

March, Jacobs, and Salvador [19] highlighted the importance of examining early-stage appropriation practices—to improve our understanding of designing for user involvement and engagement right at the beginning of the technology development. More recently, studies in online communities and citizen science have found community participants to be more willing to contribute information in areas they are familiar with [28,31]. For example, *Galaxy Zoo* is a citizen science project that invited the public to participate in astronomical classification of galaxies using web-based tools [17]. A subsequent survey found that most of *Galaxy Zoo*'s participants already had an interest in astronomy, and thus were considered self-selected to contribute to the project [30]. Eyewire, another citizen science project examining protein folding tasks, shared similar findings regarding participants' previous engagements [14].

In studies of online communities, an issue that inhibits technology adoption is the degree that the technology is sensitive to network externalities, or critical mass issues [31]. That is, the rise in value a user can derive from using the technology depends on the increase in number of people using it (e.g., a network technology like Bitcoin) [9,12,31]. Consequently, the technology would have little value when its network is small. For example, the credit card took decades to become mainstream because it required a critical

mass of merchants in order to attract more customers—while in order to attract more merchants, attracting more customers is in turn necessary [9]. In this instance, understanding why early adopters would bootstrap a sparsely used digital network is essential to designing it for successful appropriation.

Other factors that encourage technology adoption include the presence of social influencers (e.g., workplace supervisors and trusted friends) [16,26,38]. However, the availability of social influencers often also depends on the degree to which the technology is already accepted by a large number of social circles. Also, our agency to appropriate early-stage technologies may be unevenly linked to our social positioning (e.g., education, income, and social status) [22]. Thus, Straub [34] argues that it is important for adoption studies to also examine the socio-cultural dimensions beyond social influences, that is, “at the intersection of the cognitive, affective, and contextual factors.”

In sum, appropriation studies have been focusing on examining contexts in which the technologies are matured and well accepted by users. We lacked studies examining contexts in which the technologies are new—which begets our research question of under what socio-cultural circumstances the early appropriators would emerge around such technologies. In the next section, we examine the Bitcoin context—particularly its distinctive features, early controversies, and recent development, factors that set the stage for user appropriation.

3. BITCOIN

Bitcoin was published in 2009 by a pseudonymous persona known as Satoshi Nakamoto [25]. While the real identity of Bitcoin's original developer is unknown, its software codes are open sourced, thus ensuring that any developers can examine them. Bitcoin is an interesting emerging technology, as it combines two old propositions regarding design of *money* (the artifact) in a way never seen before. The first proposition is that a bitcoin (note the use of a small letter *b* to refer to the digital tokens, not the technical system) is embodied digitally, and may be sent over informational networks such as the Internet at negligible cost. This feature can also be found in virtual currencies (e.g., *Beenz*, *Flooz*, and *Linden Dollars* of the virtual world *Second Life*). The second proposition is that each bitcoin is issued by a decentralized software system, with its transactions stored in a peer-to-peer database known as the *block chain*; the block chain is not controlled by any institutional issuer. This second feature has never been seen before in other digital monies, due to cryptographers' previous inability to resolve the technical difficulty of maintaining a distributed account of who owns how much money in a decentralized monetary network; this challenge was resolved for the first time through Bitcoin [25].

As a form of digital money—a medium of exchange for goods and services—the bitcoin has not yet encountered sustainable uses; although many startup companies are being tasked to explore markets involving low-cost transmission of monetary value, or requiring open ledger technologies [10]. Due to its many controversies, bitcoin as digital money has received limited support from institutions to support its development. One contentious feature is that bitcoins are generated periodically within a peer-to-peer network, dictated by computer algorithms, in a process not logically controlled by any government entities. This unusual process of monetary production distances itself from government intervention and has led some observers to believe that bitcoins are objects of scams. Perhaps more damaging to Bitcoin's reputation was its early adoption by notorious online

black markets, such as the Silk Road, which caused bitcoin use to be associated with illicit activities. These views pose significant cultural barriers to Bitcoin’s widespread adoption [15,23].

On the other hand, the block chain has recently captured the interest of financial institutions due to its ability to mediate financial transactions among institutions without the need to involve counterparties such as clearing houses and brokers. In addition, the block chain could also store public data (e.g., smart contracts, accounting ledgers, and intellectual property rights) in a decentralized database, thus leaving an audit trail for regulators to assess a company’s financial health or contractual commitments [24,36].

Based on these two different propositions of Bitcoin, the technology has undergone two different stages of appropriation—first as a peer-to-peer digital form of money, and second as an institutionalizable block chain technology. In the first stage, between 2009 and 2012, Bitcoin was largely a peculiar tool used and supported by libertarians, and very contentiously appropriated by online black markets like the *Silk Road*. These early participants networked online through the Bitcoin Forum (bitcointalk.org), IRC channels, and other social media.

The second stage of development, more current and central to our case, is the *emergence of moderate actors—the bankers, entrepreneurs, and technology hobbyists—toward the end of 2012*. From this time, a large number of Meetup and Facebook groups were set up globally across most major global cities. On April 7, 2015, a total of 594 Bitcoin-related Meetup groups could be found across 71 countries. While Bitcoin is particularly appealing to libertarians, who developed beliefs in minimizing roles of the government on many issues including that of money [18,20,21], these new actors are more willing to work with regulators and local businesses. This stance requires a more open attitude towards eventual institutionalization of the technology—what perhaps can be considered as a significant departure from its earlier libertarian framing.

4. METHOD

The Bitcoin communities that are formed through Meetup groups are often localized to one city; that is, they are specific to geographically based Bitcoin communities. Participatory practices within these communities tend to center around networking and identifying collaborators, and subsequently developing shared practices to support local Bitcoin development. When these Meetup groups were initially formed, many of these meetings were only casually held in bars and restaurants, and functioned solely as contexts in which bankers, technologists and hobbyists, entrepreneurs, incubators, and journalists could socialize with each other. Some of these actors have a long-term agenda regarding the Bitcoin technology—for example, an incubator is looking for potential businesses to support, whereas a hobbyist may be interested in identifying Bitcoin-related job opportunities.

Over time, these long-term agendas have been reified into shared purposes which seeded the formation of formal organizations. For example, the Hong Kong Meetup meetings have existed since July 2012, and in June 2014, the most engaged participants also founded the Bitcoin Association of Hong Kong (bitcoinhk.org), which focuses on organizing formal workshops, handles enquiries from the press, and engages with local legislators regarding regulatory policies. The core members in Hong Kong also set up their own private instant messaging groups in which they discuss specific issues such as public opinion, local media coverage, and

event organization. We were invited to participate in these private discussion groups.

There were at least three advantages of using the Meetup meetings as a research site: (1) these social events offered an accessible pool of participants whom we could interview; (2) these participants were likely to have previous experience with Bitcoin; and (3) these settings acted as a context where we could observe emerging collaboration across segments of users (e.g., bankers and technologists). The key disadvantage of examining the Meetup meetings was that inexperienced users (who had encountered the technology but remained uninterested) were less likely to attend these meetings which require significant time commitment.

Table 1. List of informants with their backgrounds, when they encountered Bitcoin, and the extent of their participation.

Informant	Background knowledge			Year Encounter Bitcoin	Research and learning	Socializing	Social action
	Libertarianism	Finance and money	Software				
1		✓	✓	2013	✓	✓	
2			✓	2012	✓	✓	
3	✓	✓	✓	2012	✓	✓	✓
4	✓		✓	2011	✓	✓	✓
5			✓	2013	✓		
6	✓	✓	✓	2011	✓	✓	✓
7			✓	2012	✓	✓	
8				2014	✓		
9			✓	2012	✓	✓	(✓)
10		✓	✓	2011	✓	✓	✓
11			✓	2011	✓	✓	
12		✓	✓	2011	✓	✓	(✓)
13		✓	✓	2013	✓	✓	(✓)
14	✓		✓	2011	✓	✓	✓
15		✓		2013	✓	✓	(✓)
16		✓		2013	✓		

(✓) indicates actors who owned Bitcoin startups when they took social actions (i.e., potential conflict of interest)

From September 2013 to February 2015, we conducted in-depth interviews with Bitcoin participants as part of our participant

observation work. We primarily participated in local Meetup sessions in Singapore and Hong Kong in order to perform firsthand observation of these meetings. These meetings included casual interactions at bars, public talks and seminars, and even a junk boat trip among core participants in Hong Kong. Each Meetup session was attended by anywhere from five to 50 attendees, and lasted about two hours. As mentioned in the previous section, these attendees were mostly entrepreneurs, bankers, and hobbyists, but also included Bitcoin participants from foreign countries. While some participants were active (i.e., organizing events or developing tools), others joined one of these groups just to find out more.

In June 2014 and January 2015, we attended two 2-day conferences, one in Hong Kong and the other in Singapore, with more than 40 international speakers and hundreds of attendees discussing Bitcoin issues. During our participant observation work, the first author spent about two months, from September to November 2013, reading nearly two hundred online articles, including technical papers, newspaper reports, blogs, and online forum posts, in order to become familiar with technicalities, language, and other practices associated with Bitcoin. Through informal discussions with participants, it became clear that the local discourse primarily revolved around a few key subjects: emerging businesses, technicalities (including security and functionalities), media coverage and public opinion, investment opportunities, and regulatory policies. In particular, a few Bitcoin associations were launched around the middle of 2014 to handle public opinion as well as to engage with local regulatory bodies, although these are relatively recent developments and were not the key concerns of this study.

From these contexts, we invited 16 participants for in-depth interviews. Seven interviewees were residents of Hong Kong, five of Singapore, and four of the US. Among the interviewees from the US, two were from the Meetup group in Baltimore, one when he participated at a conference in Hong Kong, and the other through personal referral. All of our informants were male, with only one (#8) being female. Initially, we asked general questions such as: How did you come across Bitcoin? What do you think about Bitcoin? Are you working on anything related to Bitcoin? What are your future plans? We took field notes during meetings, whereas in-depth interviews were audio-recorded, and transcribed. All the interviews lasted between 30 minutes and an hour.

4.1 Data Analysis

We performed memoing and theoretical sampling during and after each interview [35]. Part of the current theme emerged during the first interview, when the interviewee voluntarily revealed how he learned about Bitcoin through his past participation. We followed this lead to also investigate the other interviewees' past participation before encountering Bitcoin. We utilized the grounded-theory method of axial coding to identify social interactions at different points of the interviewees' encounters [35]. Through axial coding, we identified conditions, actions, and effects of their experiences. Finally, we reduced these codes to those presented in this paper.

As shown in Table 1, seven of our informants had encountered Bitcoin in 2011, but only two of them engaged actively, such as volunteering for open source coding or event organization. The rest learned about Bitcoin primarily through Internet media, and kept this interest as a private activity until the development of local meetings and startup scenes. Of the four informants who learned about Bitcoin in 2012, they mostly heard about it from friends who had encountered Bitcoin earlier. Six informants were

relatively recent actors who learned about Bitcoin in 2013, due to the surge of mainstream media reports and public interest in the technology. Of the five informants who took "social action" (i.e., voluntary, nonbusiness efforts to organize events and activities in the local scenes), all of them had heard about Bitcoin much earlier, before 2013. To the best of our knowledge, all nine actors who have taken social actions are still participating in the community as of the writing of this paper. All names mentioned in this paper are pseudonyms.

5. FINDINGS

In this section, we present findings of how our informants came across Bitcoin, deliberated on the technology, and decided to participate along appropriation trajectories. We also highlight that, along with this appropriation trajectory—from encounter, research and learning, to socialization—different forms of *cultural affinities* (elements that bring the actors closer to the sites of the innovation) mediate the journey of users negotiating meanings with the innovation. *Contextual affinity* provides a cultural context (e.g., family environment, work setting, or civic event) in which a user may be exposed to the technology; *conceptual affinity* refers to her use of preconceived ideologies, concepts, and literacy to infer meanings of technological artifacts; *social affinity* describes the degree to which an appropriator can identify others to encourage and advise her in her endeavor. Although conceptually separated, these affinities interacted and worked concurrently in providing incentives for appropriation. And some affinities may be more important during certain stages of the journey.

5.1 Contextual x Social Affinities: Encountering the Technology through Adjacent Community

A social context (e.g., a community setting) offers opportunities for potential appropriators to encounter others who are aware of emerging technologies. After Bitcoin software was published in January 2009, for more than one year it remained a mere technical curiosity. There were very few appropriators apart from a handful of cryptographers and libertarians. Aside from people who belonged to these social groups, few others could have heard of Bitcoin. It was thus not surprising that all of our informants had only come across Bitcoin much later. Yoshi (#6) from Baltimore, who had come into contact with Bitcoin in May 2011, was among our earliest appropriators.

Yoshi first heard about Bitcoin in a tweet posted by an online comic writer:

There's an online comic I follow. It's written by somebody who's an objectivist, is self-described as, I guess. But his comics are more about just life, but he mentioned it in a Twitter, and while following him, he basically mentioned [Bitcoin].

Yoshi had encountered Bitcoin through a non-Bitcoin community. Other users like Yoshi encountered Bitcoin through a community with minor overlap of interest with early Bitcoin users. These are opportunities where information about an emerging technology can bridge across closely aligned social networks.

The Bitcoin community, particularly after 2012, has also shared significant adjacency with professional interest groups. David (#1), an incubator who is located in East Asia, had invested in eight companies in the US, Germany, Mexico, and Hong Kong. David knew about Bitcoin in September 2011 through a good friend in France. His friend was a financial software engineer,

who in turn knew about Bitcoin while following Occupy Wall Street, which took place after the financial crisis in 2008 to protest against the financial institutions in the US:

I know Bitcoin through a friend who is French... who is an engineer—software engineer, worked in many banks and even for central banks. He mentioned that a lot of people picked up on Bitcoin during the Wall Street Occupy movement. In Occupy Wall Street I think people started putting up signs or mentioning Bitcoin at that time as an alternative currency.

While Bitcoin is a technical artifact, it was rhetorically framed under rubrics of liberal ideals, such as the idea of a stateless society [20]. The use of Bitcoin could also represent a form of protest against the financial establishment. When viewed as a libertarian artifact, one use of Bitcoin is the ability to pseudonymously buy drugs in online black markets. This was how Zach (#4), from Baltimore, first learned about the technology:

I was living in San Francisco, and, you know, just wanted to get some weed. Since then I've stopped smoking weed, and I bought through Mt. Gox as well, which was really hard to use ... that's what got me in the door.

Traditional media, like local newspapers, are also possible outlets to learn about Bitcoin. But Bitcoin was not reported by the Hong Kong or Singapore media until early 2013. Tang, a college student from Hong Kong, was among those who only learned about Bitcoin through the media, as he had no access to earlier information sources. “The newspaper was talking about Bitcoin,” Tang told us—“that's when I started to do research about Bitcoin.”

While knowing that Bitcoin existed was important, all of our informants invariably mentioned that the next thing they did was to enter a phase of research into Bitcoin, and to learn what it was.

5.2 Contextual x Conceptual Affinities: Using What We Know in Research and Learning

By previously performing a relevant role within a community (e.g., being a banker in a financial sector), potential appropriators could embody concepts which can guide their formation of new understandings about emerging technologies. Bitcoin could be understood in many ways. It has been seen as a technical novelty with innovative algorithms. Some others see it as an investment instrument—a way to get rich. Yet others perceive it as a technology that promotes freer trades, a financial law enforcement nightmare, or “magic” Internet money! The truth is that many appropriators have to decide for themselves what Bitcoin is.

In its least contentious form, Bitcoin could be understood purely as a technical novelty. Vincent (#7) is an enterprise resource planning consultant in Singapore. From his perspective, Bitcoin is a technical artifact, and he was looking for a technical description of it. “Then I finally found what is [a] block chain, what is [the] difficulty [in] all this,” Vincent said. In the course of his research, he came to a Bitcoin trading site, an IRC channel, but its participants did not answer his questions. Undaunted, Vincent carried on with his research by reading articles on the Internet, and he uncovered a wealth of technical information. But he also found that he had difficulties shepherding his friends through the same process:

I [have] a programmer background, I understand why. Because, when some new concepts [emerge], we will

tend to explore. [And] it's a very tedious [process], and people will say, “Forget it. If it doesn't affect me, then better not touch it.”

So, this is what happened to a lot of my friends. ... I can say this is more like intrinsic motivation. ... These are the things that, like the knowledge and know-how, they aren't interested [in]. [But] when they see money [in Bitcoin]... they will start to be interested, but they still don't know how it worked.

Vincent had an interest in programming and, unlike his friends, was able to sustain an interest through a long period of Internet research. In our interviews, we found a variety of initial reactions toward Bitcoin. When asked, many of our informants used their previous experiences and knowledge to explain their reactions.

While Vincent had a technical curiosity, and was clear how Bitcoin worked, he still had questions about where Bitcoin would go from there. “A lot of people still don't know why, even myself, I don't know why bitcoin [price] will shoot up,” Vincent told us.

We encountered other informants who quite easily fostered confidence toward Bitcoin. For example, Yoshi told us that he had needed little research, and he immediately “got it” about Bitcoin's utility: “I looked into it, read about it, and all of a sudden, I'm like, ‘Hey, I know what this is and what this potential has.’” What is the difference between these two groups of users?

Yoshi was quickly convinced, he explained, due to his personal experience with another virtual currency, *Linden Dollars*:

Since about 2003, since I started in Beta even, I was involved in *Second Life*... In *Second Life*, all of that [which happened in Bitcoin] happened too, where the first year, people would make their own stuff and sell it. Then they would set up businesses. By then, it was all casinos, entertainment.

That fascinated me because all of a sudden, it was, as I said, a fast-forward developing of the real-world economy, where eventually, it got to where they actually had financial services right in the game. They had their own banks and stock markets and stuff.

The reason I'm bringing this up with *Second Life* is that it was just on the brink of developing a really good virtual economy. It was moving into the financial services. Some of us were even considering using Linden Dollars for virtual currency transactions internationally, but once the government stepped in and closed [the use of Linden Dollars for international transactions], it created a domino effect which killed all the financial services in the game.

Not only had Yoshi tried setting up a business in *Second Life*, he witnessed how global financial services may be mediated by a virtual currency. In addition, he is a libertarian, has a degree in finance, and taught himself programming. This mix of relevant literacies gave him a lot of leverage in conceiving uses for the new technology. Zach is another informant who had come to understand Bitcoin from a libertarian angle. Zach mentioned the specific sites he had frequently visited in our interview: “The Bitcoin subreddit, Anarchy or CryptoAnarchy subreddit, the Anarcho-Capitalism subreddits. Do you know Freeman Radio?” And Zach was able to develop trust in the technology through this perspective.

David, who was an Internet entrepreneur himself in the '90s, was able to look at Bitcoin from a business perspective. When he was running his startup, he developed a business model in which clients who advertised at his site would pay him using credit cards. However, David was denied a credit card payment account by his bank, which was tremendously disconcerting, as he recalled:

What's going on? Why these guys in the bank would say no to a young guy trying to start up a business?

For most Internet businesses, credit card is the main medium of payment. To be denied access to this payment option could mean a death knell for these companies. And David explained that banks today have remained highly selective about whom they do business with:

It's exactly the problem as I had and I guess, many entrepreneurs back in the '90s with Internet. The banks not only are not helping, they are actually preventing you from opening your business because if out of 140 banks, 135 say no, then imagine the tens of hundreds of entrepreneurs who just try 10 banks, and then 10 banks said no, or 20 banks, and then 20 banks say no. What do they do? They don't do it. Right?

From David's perspective, Bitcoin could be an enabler for businesses that, for various reasons, are unable to accept credit card payment.

Even before using Internet searches to research Bitcoin, many of its participants were formerly exposed to libertarianism, finance and money (including virtual currencies), and software. Table 1 shows that 13 of our informants had knowledge of software engineering (sufficient enough to understand concepts behind basic cryptography), while all five of our active volunteers had, in addition, knowledge of at least one other domain (i.e., libertarianism, or finance and money). This pre-acquired knowledge had allowed them to imagine probable use scenarios, and see meanings in Bitcoin's technicalities. The flip side is that those who lack such pre-acquired skills may not even begin researching the technology, as David said of those who kept an arm's length with Bitcoin: "They don't see what it can become. They only see what is going on at that time."

5.3 Conceptual x Social Affinities: Reifying Participation Through Socialization

By developing deeper understanding, and having conceptualized meaningful uses, of emerging technologies, potential appropriators could reach out to and communicate productively with members of new communities, and identify new collaborators. Among our informants, some would progress beyond the research phase and begin to seek social support. Informants like David who had learned about Bitcoin through a close friend had no issue finding a discussant. But most of our informants were only able to reach out to like-minded participants through social media platforms. While personal ties are helpful to promote technological adoption, we found very few informants who had old trusted friends sharing enthusiasm in Bitcoin. Thus, a vast majority of informants have maintained or nurtured their interests by interacting with strangers.

Vincent was among those who were unable to find any close friends who would support his interest in Bitcoin:

You know, I told my friends about it [but] none of them ... even bother[ed] [to discuss with] me at all. [F]ed up, I just go [on] Facebook, create a group, invite everybody.

Vincent started a Bitcoin Facebook group for Singapore that attracted 904 "likes" from Facebook users.

There is a Bitcoin Meetup group in almost every major city around the world; these groups are critical social infrastructure especially for emerging startups working on Bitcoin-related projects. By June 17, 2014, there were 546 members who had subscribed to the Meetup group based in Hong Kong, 404 in Singapore, and 89 in Baltimore. As few people know about Bitcoin, these meetings provide needed venues for participants to share information or to collaborate with people who are more knowledgeable about the technology. David shared with us his experience working with global startups:

[T]he Meetups, which are a face-to-face form of meeting, is quite important in Bitcoin. Yeah, I think as a social dimension is critical. There, as you can see, there are values that are shared among Bitcoin, in the Bitcoin community. For example, for now, it's very collaborative... People are quite open to discuss, quite open to help themselves.

Even though close friends are good sources of support for adopters, they could also dissuade their friends from participating. Tang (#5), who first encountered Bitcoin in the local newspaper, started researching it in the following months. Tang often confided to his friends and colleagues about his emerging interest:

Yeah, I started my research in September. Around that time I had introduced Bitcoin to my friends. Many of them still don't understand what it is. They just think it's very high-risk and maybe it's just like a share... How do you say it? Hoax. My [university] lecturers still gave me the signal that it's not advisable to speculate in Bitcoin.

Tang chose to remain a Bitcoin skeptic after hearing the opinions of his friends. He contemplated working on a university project developing a service robot that could accept Bitcoin, but he soon gave up on the idea. Tang smirked when he told us that he would probably be more convinced, if "at least some international trading companies like Amazon... can use bitcoins to [make purchases]."

Through social supports, many of our other informants have taken social actions, whether investing, using, or developing a related product. From the time our informants heard about Bitcoin until they started taking social actions, this period spanned between several months and more than one year. Yoshi, who had taken the least amount of time considering his earlier exposure to a virtual currency and trading, was our only exception.

6. DISCUSSION

In this study, we explored the question of how end users got involved in early-stage appropriation of an emerging technology, Bitcoin. By focusing on an emerging technology, we were able to uncover a process of appropriation predominantly mediated by sociocultural resources at the users' disposal—who they were, where they worked, whom they knew, and what they knew—that goes beyond the limited consideration of customization and reuse that the literature has focused on.

Importantly, we identified several forms of cultural affinities that mediated the participants' journey of appropriation. We used the term *culture* as defined by Boden et al. [5]:

a shared web of meanings that shapes roles and interpretations, and is dynamically (re)negotiated by the actors in the course of their daily work... [materialized] in the form of artifacts, practices and routines.

While here we can see cultural elements—artifacts, practices, and routines—as being historically construed, the process of appropriation is emergent.

Throughout the participants' appropriation trajectory—from encounter, research and learning, to participation—all forms of *cultural affinities* (elements that bring the actors closer to the sites of the innovation) mediated the process as users negotiated meanings with the innovation. These affinities interacted with each other to provide motivation for appropriation, even though some affinities may be more important during the early or later stages of the journey. For example, *context* may be more valuable at the beginning of the journey, but as the user begins to *conceptualize* the technology in his mind more regularly, the original context becomes less important than the ideas that now encapsulate his interest. Mediated by these affinities, the appropriation process spirals forward, with participants progressively conceiving new meanings through research and experimentation, while also navigating the sociotechnical labyrinth that challenges attempts to reify the technology in real-world contexts.

6.1 Cultural Affinities: Reasons for Participation

6.1.1 Contextual Affinity

Here, the term *context* is viewed at the level of social settings (e.g., a place or a site), which provide opportunities for our participants to interact with people or media surrounding technological artifacts. Our participants' access to a context is afforded by their social positioning and earlier participation in professional and interest-driven social groups (i.e., through legitimate peripheral participation) (see also [39]).

Contextual affinity provides a cultural context (e.g., family environment, work setting, and civil event) in which a user may be exposed to the technology. For example, in 2011, a community sharing contextual affinity to Bitcoin was the *Silk Road* community. And in late 2011 and early 2012, appropriators like our informant David began to develop access to Bitcoin indirectly through the Occupy Wall Street movement. Between 2011 and 2014, Bitcoin's periphery expanded as its community enlarged, leading to more potential users coming across the technology through overlapping contexts.

Here, we would like to introduce a related concept of *adjacent communities*, which are contexts that are related (i.e., "adjacent") to one another due to overlapping memberships. For example, the Bitcoin communities we examined have overlapping memberships with video game clubs and civil movements. Adjacent communities facilitate movement of actors from one participatory context to another. For example, an actor like David could not have gained knowledge about the inner working of the banking sector without years of experience participating in the startup community. Every actor, depending on their past participation, thus benefits from contextual affinity afforded by their hard-

earned social positions, and their associated daily interactions. In other words, a community's contextual affinity does not open endless pathways, but only those leading to where its members have been cross-pollinating artifacts and practices.

6.1.2 Conceptual Affinity

A concept refers to an actor's accumulated knowledge and representations about his social environment. And *conceptual affinity* refers to her use of these concepts to infer meanings of technological artifacts. Conceptual affinity is also cumulative—the more we know, the more we can learn, and the more we will come to know.

Our interviewee data revealed that while any users can learn on their own on the Internet, this is an insufficient condition for developing trust in a technology. If we take literacy to refer to a person's ability to engage with, analyze, and critique new content through the use of her accumulated cognitive operations and representations [11], then most of our successful appropriators, before they encountered Bitcoin, were already pre-equipped with relevant "literacies" through past work, school, or personal hobbies. These literacies are mental toolkits allowing users to imagine Bitcoin interacting in real-world contexts and thus to develop *personal* visions of its potential uses.

The use of conceptual affinity is seen most clearly in the case of Yoshi, who had firsthand experience with virtual trading in *Second Life* using the Linden Dollar. He witnessed how virtual derivatives and virtual exchange could evolve out of virtual currencies; and he could see Bitcoin offering similar utility. "I know what it is," he said when he encountered Bitcoin. Apart from virtual trading experiences, which were rare among our informants, other relevant literacies include finance and money (to imagine Bitcoin being used in marketplaces), software engineering (to understand its technical soundness), and libertarianism (to envision its relevance to a spirited discursive field). Most of our informants had at least one intellectual or technical interest (i.e., libertarianism, finance and money, or software), and most of them were also male (15 out of 16) (see also [1,4,34]). Our informants' conceptions, borrowed from their previous experiences, still may have contained gaps; specifically, they had not yet resolved major and ongoing contradictions between Bitcoin and the wider legal and financial complexes. The point is that these technical backgrounds motivated the informants toward appropriation regardless whether their visions may miss aspects of social realities.

As a technical tool, Bitcoin is unambiguous; but as a social artifact, it could be an investment product, a political statement, or a medium of exchange. Thus, these conceptual tools assist appropriators in their social process of finding potential meanings in technologies.

6.1.3 Social Affinity

Social affinity describes the degree to which an appropriator can identify social supports, while taking time to resolve social stigmas and contradictions surrounding an innovation. Social affinity differs from contextual affinity in that a context may contain many social groups; being in the right context may not guarantee that the user would encounter the right people. Also, technology encounter, and research and learning, can be entirely personal; a user need not discuss these experiences with others. But at times, when he does bring up his new-found ideas with others, he may find welcoming support which encourages him to further his interest. Or he could also find his way into an adjacent community, where he can establish new, supportive relationships.

The truth is that innovations at a very early stage of development often lack public understanding and empathy, making it difficult for early-stage appropriators to leverage social affinity. Among our informants, only a few like David had access to close friends with whom they could discuss Bitcoin. This is a reason some of our informants sought out online communities to identify discussants. But online communities are not always welcoming to learners; for instance, Vincent found that the Bitcoin IRC was unwelcoming to beginners asking basic questions. Instead, he fell back to reading articles on the Internet, and seeking new local ties on Facebook. Unlike online forums, Facebook (also Meetup) communities aggregate and hybridize virtual and local interactions, with social groups conducting the same discourses but oscillating between online and offline formats.

In a community, meanings are conceived through an extended period of social interactions between members [39]. And the Bitcoin meetups provide a cultural blank slate in which members can negotiate new meanings without being overly burdened by social stigmas. This fresh start is important because the technology's current design has inherent contradictions with legal and financial structures, which also vary between countries and localities. Members of local communities (e.g., entrepreneurs), especially those intent on reifying Bitcoin into concrete products, have to resolve these contradictions with law enforcement agencies, local legislatures, finance actors, and the public.

7. CONCLUSIONS AND IMPLICATIONS

In this study, we contributed the notion of *cultural affinities*, filling a research gap within the appropriation literature, which had focused on personalization and reuse of matured technologies. By investigating user appropriation of Bitcoin, an emerging technology, we were able to identify sociocultural factors influencing early-stage appropriation—a phenomenon that is rarely observed among users of matured technologies. We found that during early-stage appropriation, the innovator's key task is not just to provide technical support to users, but to engage them—encouraging them to muster their contextual, conceptual, and social resources—to build a cultural enterprise (e.g., meaningful-use cases and practices that build on techno-utopian narratives). The period of time from users' first encounter to when they were ready to invest their time in the community ranged from months to more than one year among our informants. Importantly, we have pointed out that user-appropriators were in fact already interested in real-world possibilities of the technology (as was reported in previous studies [14,30,32]) through which they could remix meanings. Thus, technological appropriation is not simply a use proposition, but a cultural proposition; the innovators are attempting to engage users to establish a technology that extends existing and notable cultural framings (e.g., Bitcoin as a libertarian tool, or as a financial technology).

A design implication is that, to encourage appropriation, innovators need to identify and develop relationships with these pre-existing and culturally rich communities. Innovators may identify communities (i.e., contexts) that have members who are pre-exposed to the technology (i.e., social affinity), and also the ideologies that motivate their interests (i.e., concepts). Innovators may then invite potential users to codevelop the technology in ways these users perceive to be meaningful. While innovators may claim ownership of the technology's blueprint, its future uses often lie in the hands of its early appropriators. In the case of a radical innovation like Bitcoin, innovators may even consider inviting users to form a whole new community (e.g., through financial and technical support) to develop a newly reified set of

meanings and purposes conducive to the innovation. Importantly, cultural affinities provide ways of discovering and identifying user-appropriators who will play important roles fostering their own personal agendas, meanings, ethos, and narratives into emerging technologies.

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