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# HCI for Blockchain: Studying, Designing, Critiquing and Envisioning Distributed Ledger Technologies

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**Abstract**

This workshop aims to develop an agenda within the CHI community to address the emergence of blockchain, or distributed ledger technologies (DLTs). As blockchains emerge as a general purpose technology, with applications well beyond cryptocurrencies, DLTs present exciting challenges and opportunities for developing new ways for people and things to transact, collaborate, organize and identify themselves. Requiring interdisciplinary skills and thinking, the field of HCI is well placed to contribute to the research and development of this technology. This workshop will build a community for human-centred researchers and practitioners to present studies, critiques, design-led work, and visions of blockchain applications.

**Author Keywords**

Blockchain; Distributed Ledger Technology; Trust; Privacy; Infrastructure; Design Methods; Bitcoin;

**ACM Classification Keywords**

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

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## What is Blockchain?

At a high level, a blockchain can be described as a combination of three powerful technologies:

### *Distributed ledgers:*

A blockchain is a ledger of transactions in a database shared between multiple actors who each hold read and write permissions.

### *Immutable storage:*

Changes or 'transactions' on the ledger are stored in 'blocks'. Each copy of the database retains every block in a linked 'chain', as an immutable history.

### *Consensus algorithms:*

Consensus algorithms provide protocols to verify the transactions submitted to the blockchain and achieve a shared consensus about the state of the database.

The effect of these technologies is to support networks of trustless peers in undertaking and computationally verifying a series of trusted transactions.

## Background

### *Introduction*

Blockchains and distributed ledger technologies are perhaps most notable for underpinning the cryptocurrency Bitcoin [8], amongst many others. However, of late, researchers in academia and industry have recognized blockchain infrastructure as a 'general purpose technology' [5] with the potential to fundamentally transform the way distributed networks of peers can trust, transact, collaborate, organize and identify themselves.

As early as 2014, Swan [12] proposed three evolutions of blockchain. *Blockchain 1.0* describes Bitcoin and other cryptocurrencies, and concerns the secure transaction of digital property. *Blockchain 2.0* describes the development of decentralized economies and financial instruments, based on the implementation of 'smart contracts': self-executing code that is immutably embedded in a blockchain. The most well-known example of a Blockchain 2.0 technology is 'Ethereum' (<https://www.ethereum.org/>). First developed in 2015, Ethereum proposes to build a decentralized internet, and supports the deployment of 'decentralized applications' ('dapps') on its blockchain platform. Beyond this, *Blockchain 3.0* articulates decentralized principles of governance and justice throughout society, underpinned by the diffusion of blockchain technology.

Beyond Bitcoin, which continues its volatile rise in value, potential applications of Blockchain 2.0 are being envisioned in all manner of domains. Financial services and asset management might be streamlined, made more transparent or opened up to smaller investors. A distributed and immutable ledger could afford 'proof-as-a-service' in contexts such as document

management (e.g., <https://www.factom.com/>), supply-chain mapping (e.g., <https://www.provenance.org/>), and international development (e.g., <http://www.disperse.com/>). Developers have proposed that a third-party ledger, governed by smart contracts can afford 'self-sovereign identity' (e.g., <https://www.civic.com/>), with individuals gaining much more control of their own data and its transmission.

Many of these domains, such as currency, and identity and data management are longstanding areas of interest for the CHI community. But throughout, there are more fundamental interactional, infrastructural and societal issues at stake, which warrant the attention of HCI researchers and practitioners, and which this workshop will surface and address.

While previous work in HCI and related fields has addressed, in particular, the users and infrastructure of Bitcoin (e.g., [2,6,10,11]), efforts to address the socio-political, technical, economic and cultural implications of blockchain more fundamentally are only emerging. Lustig and Nardi point to the Bitcoin protocol as a case of 'algorithmic authority' [7]. Nissen et al.'s DIS 2017 workshop [9] specifically considered the potential of Distributed Autonomous Organizations (DAO's) in mediating new value transactions. Jabbar and Bjørn [4] point to the wider infrastructure and necessary materiality of blockchain services and applications. This recent work frequently highlights the fundamental human challenges requisite in interactions with blockchain and distributed ledger technology.

This workshop seeks to foster such constructive and critical perspectives, and identify specific areas of interest and relevance for HCI. These may include:

*Transactions and Financialization*

Transactions are a basic component of how people interact with a blockchain. This feature is most evident in the exchange of a new forms of currency or tokens, which could be paid, or rewarded on the basis of any kind of definable interaction – such as viewing an advert (<https://brave.com>), entering a chat group (<https://kin.kik.com>), or upvoting a comment (<https://steemit.com>). These may provide the basis for a metered internet, but more fundamentally, Iaconesi [3] argues that reducing such interactions to transactions, risks a ‘financialization’ of everyday life. This view begs questions about the lived experience of life on the ledger.

*Designing for Privacy and Trust*

Blockchain technologies potentially reframe existing privacy challenges, and implicate new models of trust. Rather than needing to trust the actors or mediators in an exchange, users are expected to trust a technical protocol. Werbach [13] describes this as ‘trustless trust’. The promise of blockchain technologies is in supporting new forms of collaboration and privacy between actors who previously could not trust each other. However, Sas and Khairrudin’s studies [10,11] of cryptocurrency exchanges show that even while the underlying Bitcoin protocol may be secure, interactions with blockchain applications can create new mediators and require new frameworks for trust and privacy. In particular, we may ask how privacy rights gained through GDPR, or the ‘right to be forgotten’, can be accommodated with DLT’s.

*Decentralized Economies*

By underpinning peer-to-peer economies, blockchain technologies can foster the self-organization of crowds

and publics. These are issues of longstanding and contemporary interest to HCI, with the potential for both empowerment and exploitation. The opportunities and challenges in displacing existing mediators is apparent, for example, in the context of international development. Currently, large NGOs, governments and corporations mediate the centralized delivery of much international aid. Blockchains might offer greater transparency, and more direct relationships and economies between donors and recipients. However, the actual work of aid organizations on the ground is complex and perhaps not so easily abstracted.

*DAO’s and Algorithmic Governance*

For some, the prospect of breaking up, or radically reforming existing centralized models of governance and exchange is the central promise of blockchain. However, as a socio-technical infrastructure, blockchains replace existing mediators with new forms of algorithmic governance. This especially extends to networks of things that can enact agency through smart contracts, and function as distributed autonomous organizations (DAO’s). There are fundamental questions to be asked about how these new forms of governance are constructed, understood and made accountable.

**Developing an HCI Agenda for Blockchain**

These areas above briefly demonstrate the technical complexity, political envisioning, and societal implications that are replete in blockchain projects and applications. Undoubtedly, research on these areas requires an interdisciplinary approach, to which HCI is well suited. In particular, we look at a history of work in HCI (e.g. [1]) that seeks to connect an understanding

of underlying infrastructure, to the resultant messy realities of lived experience and human values.

While it is evident that there are many new, ongoing research projects in this area, we would argue that the HCI community has yet to fully find its voice. To this end, the central aim of this workshop is to bring together leading researchers and designers to articulate the opportunities, challenges, and distinct role which the CHI community can and should play in the research and development of this emerging technology.

On the most basic level, this workshop is an opportunity to share common experiences, challenges, and best practices. But, we will also develop an agenda for future research around four core strands:

#### *Studying Blockchain Applications*

- Existing user communities
- New application areas
- Infrastructural studies
- Case studies

#### *Critiquing Blockchains*

- The politics of blockchain
- Developing theories and concepts
- Critical design approaches
- Algorithmic accountability

#### *Designing for and with Blockchains*

- Co-designing with blockchains
- Participatory methods
- Toolkits
- Using off-the-shelf applications
- Design probes
- Lessons learned

#### *Envisioning Blockchain Futures*

- Expanding the imagination of blockchain applications
- Artist projects
- Speculative approaches
- Designing 'critical infrastructure'

### **Organizers**

We have a large organization team for this workshop, reflecting a breadth of expertise, with experience in research and industry, across five different institutions.

*Chris Elsdén* is a post-doctoral research associate in the School of Design, at Northumbria University. He is currently working on the 'OxChain' project, exploring blockchain technologies in the context of an international NGO, Oxfam, and their network of second-hand stores. He has previously led the organization of two successful CHI workshops, 'Beyond Personal Informatics' (CHI 2015) and 'Quantified Data and Social Relationships' (CHI 2017).

*Bettina Nissen* is a Research Associate on the ESRC funded After Money project in Design Informatics at Edinburgh University. Through design-led engagement activities and interactive provocations, this research aims to introduce the underlying principles of blockchain and smart contract technologies to audiences that are not commonly consulted on the development of new currencies or FinTech technologies. She has prior experience of organizing public engagement events and successful workshops such as 'New Value Transactions' at DIS 2017.

*Karim Jabbar* is an Industrial PhD Fellow at the Department of Computer Science at the University of

## Workshop Schedule

09:00-09.15  
Welcome

09:15-10:00  
Panel 1

10:00 – 10:45  
Panel 2

10:45 – 11:00  
Coffee Break

11:00-12:00  
Panel 3

12:00-13:30  
Lunch

13:30-14:15  
Panel 4

14:15-14:45  
Formation of Working Groups

14:45-15:00  
Coffee Break

15:00-16:30  
Working Groups

16:30-17:00  
Report and Next Steps

Copenhagen. His research area is focused on the socio-technical dimensions of Blockchain technology, in particular the emergence of start-ups working at shaping Blockchain as an information infrastructure. More specifically his research has looked at Bitcoin mining and physical gateways such as Bitcoin ATMs (BTMs), as well as industry applications of Blockchain technology in the maritime and supply chain domains. Karim is also a co-founder of the Blockchain Labs for Open Collaboration (BLOC), based in Copenhagen.

*Reem Talhouk* is a doctoral trainee in Digital Civics at Open Lab, Newcastle University. She is currently working on 'SunBlock', a project that explores the use of blockchain in supporting peer-to-peer energy exchange within off-grid solar energy systems in Sub-Saharan Africa. Her research also encompasses the use of technologies within developing contexts and by refugees.

*Caitlin Lustig* is a PhD candidate in the Informatics department at the University of California, Irvine. Her research broadly examines the values, ethics, and authority of large-scale autonomous software systems. She currently researches how members of blockchain open source communities use code to negotiate their values and express their imaginations about the future of autonomous systems. She has organized multiple events on the critiques, designs, and futures of algorithmic systems; including the CHI 2016 panel on 'Algorithmic Authority', and workshops at CSCW 2016 and ICWSM 2017.

*Paul Dunphy* is the lead researcher on the distributed ledger technology research theme at VASCO Data Security, based at their Innovation Centre in

Cambridge, UK. Prior to joining VASCO he spent time at Atom Bank: the UK's first bank to deliver services entirely via mobile applications that pioneered the use of mobile biometrics, and completed a Microsoft Research funded PhD at Newcastle University. His research is generally situated at the intersection of HCI with information security and privacy.

*Chris Speed* is Chair of Design Informatics and Co-Director for the Centre for Design Informatics, at the University of Edinburgh. Chris leads UK research council funded projects that investigate the social and economic implications of the design and application of blockchain technologies with partners that include Oxfam, Royal Bank of Scotland and the New Economics Foundation. The Centre for Design Informatics have pioneered workshops and experience for blockchain by design (DIS 2017).

*John Vines* is Professor of Design at Northumbria University, and specialises in participatory approaches to designing technologies and the study of participatory technologies in communities. John's research cuts across several topics, including technology design for later life, social care, personal and community health, civic engagement and financial inclusion. He is working on several projects involving the participatory design and application of blockchain technology in financial and civic contexts.

### Website

<http://hciforblockchain.org>

### Pre-Workshop Plans

The organizing team are already connected with many other researchers working in this space, who will

support the workshop as a program committee and advisory board. This group will help us to advertise the workshop widely, solicit a broad range of submissions, act as a sounding board, and where appropriate, review workshop submissions.

Our Call for Papers will be promoted widely through relevant networks and mailing lists. Participants will be invited to submit short 3-6 page position papers, which relate to the areas of interest outlined above. The deadline for submission will be 26 January 2018.

Beyond the quality and relevance of submissions, we will also aim to ensure an interdisciplinary and balanced group of researchers is able to attend the workshop. We intend for 15-20 participants to attend the workshop, in an effort to build a strong community of researchers working in this space.

### **Workshop Structure**

We recognize that participants attend workshops primarily to meet and interact with other researchers working in the same area, while having the opportunity to present their own work. For this reason, our one-day workshop will be organized around a series of discursive panels, followed by working groups to address specific challenges.

In previous workshops, we have used curated panels to great effect, where participants are invited to give brief successive presentations, which are then collectively discussed. In this case we will thematically group 4-5 participants per panel based on their position papers. Each will be given 5-7 minutes to introduce their work, allowing 20 minutes of discussion, which will be

carefully documented by the organizers, for later reflection.

We will be responsive to the content of the submissions the workshop receives, but envisage four themed panels to address the broad areas of interest: *Studying*, *Critiquing*, *Designing*, and *Envisioning*.

Following this, we will use the second half of the workshop to form a series of dedicated working groups, which will respond to the issues raised during panel discussions. These working groups will be tasked with developing and documenting specific short and long-term aims, and potential ways forward in those areas. For example, one working group may address 'Participatory Design with Blockchain' and propose the development of a toolkit to introduce blockchain technologies to participants. In this way, we hope to conclude the workshop with pragmatic and productive calls to action to develop a new community.

### **Post-Workshop Plans**

Our post-workshop plans will be strongly informed by the themes and activities of working groups formulated during the workshop. We believe these could seed many specific and practical activities that would benefit the community.

At a minimum, we propose to write a workshop report or white paper, to share with the wider community, and which may also form the basis of a publication, for example in *Interactions* magazine. We also anticipate that this broad agenda-setting workshop will unveil opportunities for further workshops which address specific topics, such as designing with blockchains.

**Call for Participation**

This workshop aims to develop a community and agenda within the CHI community to address the emergence of blockchain, and distributed ledger technologies (DLTs). As blockchains rapidly emerge as a general purpose technology, they present exciting, and interdisciplinary, challenges and opportunities for developing new ways for networks of people and things to transact, collaborate, organize and identify themselves.

The format of the workshop will be structured firstly around a series of panels, related to:

- Studying applications of blockchains
- Critiquing blockchains
- Designing for and with blockchain technologies
- Envisioning blockchain futures

These panels will create a space for attendees to present and discuss their work, sharing expertise, as well as common experiences and challenges. Secondly, the workshop will transform these discussions into an active agenda for future HCI research, through a series of working groups to address specific issues and interests.

Participants are asked to submit a 3-6 page position papers (in CHI Extended Abstract format, as PDF) – by email to [hciforblockchain@outlook.com](mailto:hciforblockchain@outlook.com) by 26 January 2018 – presenting aspects of their own work (or work-in-progress) relevant to the four core themes of the workshop, and areas of interest described in the proposal. Submissions should also include a short personal biography (max 200 words). These papers will be reviewed by the organizing committee, supported by a wider program committee where necessary.

At least one author of each accepted position paper must register and attend the workshop. All participants must register for both the workshop and for at least one day of the conference.

**Website**

<http://hciforblockchain.org>

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