IS4SI Conference Track:
The Future of the Global Infosphere

The earthDECKS Learning Engine

A Hybrid Human-AI System for Impact Tracking

Zann Gill, Guido Carlomagno, Tad Hogg, Ray Podder, Nicholas Wilson
earthDECKS.org | earthDECKS.net | earthDECKS.com

Abstract. Debates about how long industrialized civilization has to address climate change, systemic pollution, and other complex systems problems forestall the greater question: What methods can we use to start addressing global challenges that we continue to exacerbate? Rather like the spark that originated life, a promising method must be conceived such that a small start has capacity to replicate, mutate, adapt to contextual demands, and evolve.

As a starter method that can grow into a global collaborative problem-solving system, we propose a distributed collaborative intelligence network powered by a hybrid human-AI framework: the earthDECKS Learning Engine with tokenization via a complementary currency system tied to impact tracking. This platform combines human collaborative intelligence with reasoning, inference and clustering mechanisms, enabled by an AI-monitored token reward system to incentivize user behavior toward positive real-world eco-social action.

Keywords: collaborative intelligence, complementary currency, hybrid human-AI, impact tracking, learning, reasoning, inference, clustering, recommender systems, tokenization

Introduction

The earthDECKS Learning Engine is a hybrid human-AI system, backed by machine-learning mechanisms for clustering, reasoning and inference to enable humans to create, adapt and apply knowledge collaboratively across a broad ecosystem.

This hybrid human-AI system can support Embedded Continual Assessment and ongoing system adaptation and evolution. Ongoing impact tracking and assessment integrates human capacity for recognizing, rating and comparing patterns with AI capacity to synthesize input from a multi-agent system of pattern recognizers for AI-calculated impact tracking. The spending on AI in competitive enterprise was $24 billion in 2018.[1] We aim to show that AI has equal importance to support collaborative ecosystems.

World Game – Historical Antecedent

Buckminster Fuller's concept for World Game (1961) predated the Internet and mobile technology needed to implement this global problem-solving concept. Massive multi-player online games did not yet exist. Instead, several hundred players assembled in university gymnasia to play World Game. An enormous dymaxion map was laid out on the floor as the gameboard.[2] A day-long improvisational theater experiment in collaborative problem-solving occurred. All players were given hard copy manuals, instructions and assigned roles, either as officials or as citizens of countries (with the number of citizen gamers proportional to each country's actual population). The players, from students to senior citizens, became engaged in this experiment. At the end, some recounted the significance of what they realized through playing World Game and how it changed their understanding of our co-dependency on this planet.

For several decades, this hard copy version of World Game was played around the world and described as "a script … [for] a production ensemble of gigantic proportions to achieve a new science of action in testing out the script. That is what a metaphor can do when it is powerful enough and when it is successfully delineated by the consummate artist of his era – that is what Buckminster Fuller has done with the design of his World Game."[3] In May 1968 World Game was presented by Dr. Fuller to a White House sponsored conference, convened for this purpose in Washington, D.C.; to the Muskie Committee to establish a select Senate Committee on Technology and the Human Environment in March 1969; to the Joint National Meeting of the American Astronomical Society and the Operations Research Society of America in June, 1969; and to the United Nations Conference on Human Survival in May, 1970.[4] After an intense flurry of interest, this Reality Game, conceived ahead of its time, was archived. What it accomplished was to inspire a new, interactive learning paradigm where game participants were made aware of global interdependencies and problem-solving challenges.

Is there an updated 21st century re-vision of this game concept that can harness AI, the Internet, and smart systems? Sustaining the planet is much more than an AI project. Twitter can rapidly mobilize many people to comment, but the synthesis challenge is not addressed.[5] Wikipedia exemplifies the collaborative creation of an encyclopedia,[6] but the collaborative creation of solutions for global problems requires a whole new business model – a distributed, bottom-up problem-solving model to develop and implement solutions such that many small efforts can be coordinated into a massive mobilization strategy.

earthDECKS – a 21st Century Model

DECKS in earthDECKS refers to a Distributed, Evolving, Collaborative, Knowledge System. DECKS are comprised of digital knowledge-cards (i.e., short stories, media portals, and other information resources about a topic) and user profiles, which integrate explicitly and implicitly collected information about each user, organizing a diversity of social signals.[7]

Users make choices about the DECKS that they assemble and the methods they choose to "make media actionable."[8] These choices are aggregated into the user's profile, which is represented as a generalized "avatar" or icon on the earthDECKS platform.[9]

Projects on the earthDECKS platform serve as hubs around which to generate, organize and connect DECKS. Knowledge-cards within a DECK (as well as across DECKS) are correlated and tracked through both manual and automated meta-tagging, clustering, and activity logging. The AI intermediary uses this information to provide recommendations and social media services to users based on their profiles.[10]

Human pattern recognition acts on recommendations (choosing either to follow them or not), which enables machine learning to adapt and improve capacity to recommend. In this way, the earthDECKS Learning Engine evolves as users navigate diverse paths through this ecosystem, browsing projects, commenting on stories, engaging with other users, attending real-world events, and performing tasks in the real world that are reported back and tracked online.[11]

Collaborative Intelligence in Hybrid AI

The earthDECKS Learning Engine embodies five theoretical principles that characterize how collaborative intelligence operates in an effective problem-solving ecosystem.[12]

First, collaborative autonomy implies that every intelligent agent in the system, whether human or device, is empowered to act independently, without permission from higher authority, or requirement for actions to align with a pre-established consensus: the earthDECKS Learning Engine is not a consensus-driven system. How each action is trusted and admitted (or not), accepted and valued, or demoted and discarded, evolves in this multi-agent ecosystem, based on the values of all agents in the ecosystem.

Second, collaborative intelligence is the global ecosystem result of the individual collaborative autonomy of all agents in the ecosystem. Unlike collective intelligence, where all agents are anonymous and equal, in a collaborative intelligence ecosystem, all agents are non-anonymous and unequal. They have different needs to be satisfied and different contributions to make, which aligns with the original aim of capitalism to empower individuals.[13]

Third, the utility function, and associated profile of every intelligent agent in the ecosystem, are uniquely co-defined, both by that agent's starting profile and by the actions performed by that agent in the ecosystem. In this way, the profile of the agent evolves, based upon how each agent's actions in the ecosystem contribute to the well-being of other agents in the ecosystem. The term *utility function*, when introduced by moral philosophers Jeremy Bentham[14] and John Stuart Mill,[15] focused on how to measure utility for each individual. When later adopted by neoclassical economists, the term was redefined to refer to *consumers*, rather than *agents*, which launched the abuse of private information.[16] The original concept was applied to agent satisfaction from choices made. The adapted term referred to a consumer's preference when offered a set of choices – what the consumer chooses, rather than the satisfaction an agent realizes from making that choice. Returning to the original intent of the term by focusing on agents, and the impacts of their actions, rather than consumers, our focus is not only on what an agent chooses when offered a choice set, but also on how other agents are impacted by that agent's choice, i.e. the cascade of impacts (assessed as responses) in the network.

Fourth, token rewards assign a value to each action in the ecosystem, as defined by all agents affected by that action. The values assigned to actions evolve as the agent population changes and as the needs of the ecosystem change. Values are recognized by token rewards such that those who contribute most, as assessed by the responses of other individuals in the community, receive the most token rewards, and become "enriched," not by hoarding, as in a capitalist economy, but by contributing. Their profile rises, not only as they receive token rewards for actions that contribute to the well-being of others in the ecosystem, but also as they spend those token rewards to enable other actions, by recycling tokens back into the ecosystem. Guido Carlomagno's work focuses on developing complementary currencies as a way to implement a virtuous philanthropic cycle to overcome the control of mega-corporations and financial institutions, a way to empower the 99% to address social and environmental problems. Ray Podder is implementing the earthDECKS tokenization system using real time DID's (Decentralized IDs) with a chain agnostic universal API parser supported by AI.[17]

Fifth, impact tracking is traditionally seen as the application of pre-defined criteria for measuring the impact of actions. In the earthDECKS ecosystem, assessment criteria must evolve. All individuals in the system have starting profiles, which evolve as they act in the system. Values assigned to contributions to the system also evolve, as in any market-driven economy. And utility functions evolve, as do the criteria for tracking impact.

earthDECKS Tokenization and KPIs

The tokenization system is directly tied to earthDECKS KPI's (Key Performance Indicators), which are prioritized and evolve based on human use of the system.[18] Motivation and emotional engagement drive commitment.[19]

KPIs attach values to a range of different actions taken, both within the earthDECKS online ecosystem and offline in the real world. Contribution to the community in its many possible forms is incentivized by token rewards that unlock new opportunities, enhance reputation, and offer advancement to leaders whose actions are rated as having high positive impact.[20] The token allocation system is directly tied to impact tracking in a collaborative, intelligent, integrated and constantly evolving ecosystem. The earthDECKS Learning Engine assigns values to a range of different actions, both within our online platform and in the real world. Incentives to perform actions that contribute to projects that serve a community are buttressed by token rewards that unlock new opportunities, enhancing the performer's reputation.[21]

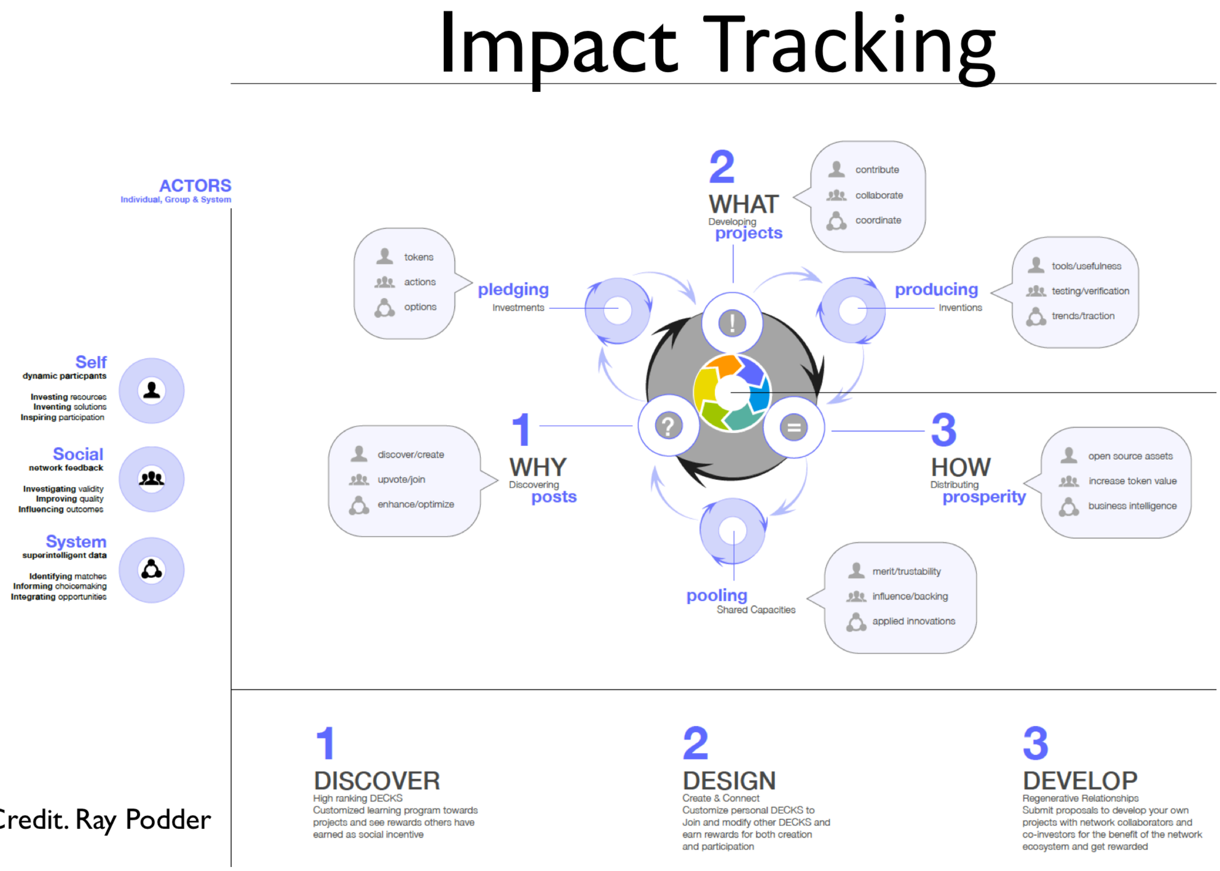
The greatest challenge for implementation is tracking the metrics to measure rewards earned, and developing reliable, transparent, integrated and automated measurement and scoring systems. Emerging new technologies, particularly artificial intelligence (AI), offer a way to assess the complexity of such systems and manage their implementation.[22] In the earthDECKS complementary currency model, the token allocation system is directly tied to impact tracking in a collaborative, intelligent, integrated and constantly evolving ecosystem.[23]

The complementary correlation of economic rewards with social good is a reduction to practice of multi-agent systems of intelligent exchange that enable collaborative problem solving, which cannot operate at scale without a collaborative intelligence infrastructure that harnesses the tools of AI in human contexts for learning, creating incentives for community cooperation and development. Sustaining the planet, improving the wealth distribution process, and promoting social cooperation in place of social competition can be enabled by AI to support a whole new social and economic model.

The default value settings on startup of a particular story hub (called a Project) evolve as human users define what they see as important about that project (or not), and how each story about that project drives action with impact, as assessed by human users.

Diverse, distributed projects serve as hubs for reporting about those projects.[24] Values for tasks performed are assigned by human project leaders. The hybrid AI "collaborative intelligence" of the system integrates human agent choices with AI capacity to track the cascade of human responses in the network, a complex system offering recommendations from a continually updated AI repository. As human individuals act with collaborative autonomy, the AI Impact Tracker calculates the network effect and distributed impacts of their actions, which tokenization rewards.

Sites (both real world and online, both problems to solve and successful innovations) are visited, pictures taken, and questions posed. All players receive points and other rewards for their contributions.[25] As in any commenting system, all players can provide stories or comments. A digg-type rating system enables the best-rated stories and comments to rise. Token rewards are offered for each challenge post, for achieving benchmarks in the challenge, and for beating each challenge. Short supply and high demand drives the reward tokens for a particular type of activity up. High impact rating and valuation of the performance of that activity also drives tokens up.

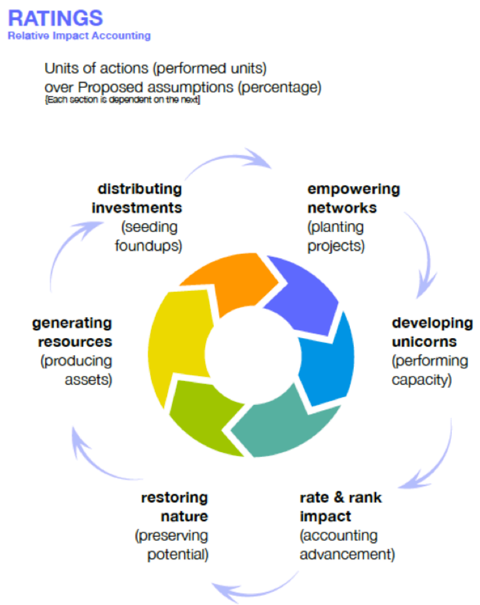


Credit. Ray Podder

Impact Tracking via Tokenization

In its purest form, currency was conceptually intended to serve as: (1) a medium for exchange, (2) a unit of accounting, and (3) a reserve of value. However, the current global financial systems have failed to fulfill their main assignments—allocating resources and effectively supporting productivity in the economy.[26]

In response to these deficiencies, new models of economic cooperation, value exchange and resource allocation have arisen in civil society.[27] The main features these models share is a new collaborative approach to economic management (as opposed to the ultra-competitive nature of modern capitalism) and an improved way to allocate resources based on merit. Merit is here intended to reward forms of social engagement, commitment, impact and contribution.[28] Many academic researchers and economic commentators believe that we are moving towards a new concept of money, based on actual, measurable contribution that augments reputation. Reputation inside a community is earned through social engagement, commitment, and impact via contribution.[29]



Credit. Ray Podder

The system allows for the advancement of leaders whose merits are rated as having high positive impact and whose status can be exchanged for other forms of currency, "influencers" whose social status is tied to positive social impact. Merit rewards ecologically and socially positive engagement, commitment, impact and contribution. This incentive system supports the view that future financial models are moving toward a reputation-based form of currency.[30]

Project impact tracking is powered by human reporting, with both manual and machine key word tagging for AI tracking. Users power the system through their choices of stories to read and rate, and the options they choose to "make media actionable." Users generate stories that support project impact tracking. Projects that contributors select to work on receive more tokens than projects whose stories are merely read and not acted on.

The Learning Engine evolves as adult contributors and students navigate their paths through its online ecosystem. The AI Tracking System keeps records of all choices made, and actions performed in the system, using those records to inform its recommendations to users. Human pattern recognition acts on those recommendations or not, enabling the AI system to learn and improve its capacity to recommend.

The use of a tokenization strategy to drive system adaptation requires AI for Embedded Continual Assessment, and ongoing adaptation of the earthDECKS Alternative Currency Ecosystem. Human decision-makers bring their pattern-recognizing skills to each decision-making context. AI calculators track the diffusion of network impacts, assessing token rewards as the system continually evolves.

The tokenization strategy has built-in protections against gaming the system. How tasks are valued in tokens evolves. Project impact ratings evolve, as does user leadership in the ecosystem. Complex system network effects occur as project complementarities are identified by humans and the AI system, enabling projects to collaborate with each other.

Beta Test Results
In November 2018 earthDECKS ran beta tests of our demo app PLASTIC (earthDECKS.org) with more than twenty testers. The half hour navigation section of the test was followed by a freeform, hour long brainstorm. The diversity of reactions and suggestions confirmed that we are on the right track to create a system that can elicit diverse reactions from a diversity of users, a platform where their unique profiles can be expressed by their choices as they navigate, making media actionable, both online and offline.

Conclusion
The analytics challenge for the earthDECKS Learning Engine is to track the types of metrics needed to reward constructive performance in a way that is reliable, transparent, and also

provides integrated, automated measurement and scoring. Emerging technologies, particularly in deep learning, offer promising assessment tools.

Tokenization uses modern machine learning techniques to facilitate tracking merits and adapting to the fluctuations in the intrinsic valuations of merit categories on the earthDECKS platform. Ongoing impact assessment, aided by AI, synthesizes input from a multi-agent system and tracks Key Performance Indicators (KPIs), correlating tokenization, which adapts and evolves as users interact with the ecosystem.

The result is a testbed that is not only itself a learning system but that also offers users a novel learning experience. The earthDECKS Learning Engine enables reasoning, searching and clustering to augment human proficiencies in pattern-recognition, association and collaborative engagement. Tokenization rewards collaboration and represents a step toward the ultimate goal of economic resource allocation based on merit.

The basic objective of the earthDECKS Learning Engine is to improve the capacity to match users to knowledge and to each other, enabling contributors to generate and disseminate information more effectively. The larger goal is to improve human collaboration across disciplines, across language barriers, and where complementary skillsets are needed to develop solutions to real-world complex systems problems.

---

[1] International Data Corporation (IDC) Worldwide Semiannual Cognitive Artificial Intelligence Systems Spending Guide. https://www.idc.com/getdoc.jsp?containerId=prUS44291818

[2] Dymaxion Map. http://www.earthdecks.net/world-game/

[3] R. Buckminster Fuller. January 1971. The World Game: Integrative Resource Utilization Planning Tool. Foreword by Thomas Broussard Turner. ix. https://www.bfi.org/sites/default/files/attachments/literature_source/world_game_series_document1.pdf

[4] ibid. xi.

[5] V. S. Subrahmanian, Amos Azaria, Skylar Durst, Vadim Kagan, Aram Galstyan, Kristina Lerman, Linhong Zhu, Emilio Ferrara, Alessandro Flammini, Filippo Menczer, Rand Waltzman, Andrew Stevens, Alexander Dekhtyar, Shuyang Gao, Tad Hogg, Farshad Kooti, Yan Liu, Onur Varol, Prashant Shiralkar, V. G. Vinod Vydiswaran, Qiaozhu Mei, Tim Huang: The DARPA Twitter Bot Challenge. 2016. CoRR abs/1601.05140

[6] Gill, Zann. 2013. Wikipedia: Case Study of Innovation Harnessing Collaborative Intelligence. In: The Experimental Nature of New Venture Creation: Capitalizing on Open Innovation 2.0, edited by Martin Curley and Piero Formica. Dordrecht, Springer.

[7] Hogg, Tad and Lerman, Kristina. 2015. Disentangling the Effects of Social Signals. Human Computation (2015) 2:2:189-208. ISSN: 2330-8001, DOI: 10.15346/hc.v2i2.4.

[8] Sun, R, N Wilson. 2011. Motivational processes within the perception–action cycle. Perception-action cycle, 449-472.

[9] Hagel, John and Gemma Mortensen, Co-Chairs of the Global Future Council on Platforms and Systems. 2018. White Paper. Systems Leadership and Platforms – How to mobilize people to transform systems and build the platforms to scale these efforts. World Economic Forum.

[10] Sun, R, N Wilson. 2014. A model of personality should be a cognitive architecture itself. Cognitive Systems Research. 29, 1-30.

[11] Brzozowski, Michael J., Sandholm, Thomas, Hogg, Tad. 2009. Effects of feedback and peer pressure on contributions to enterprise social media. In: GROUP09 - International Conference on Supporting Group Work. 2009. pp. 61-70. http://doi.acm.org/10.1145/1531674.1531684

[12] Gill, Zann. 2013. The Other Edge of Ockham's Razor: The A-PR Hypothesis and the Origin of Mind. In: *Biosemiotics*. Special Issue "Origins of Mind" edited by Liz Stillwaggon Swan and Andrew M. Winters, Dordrecht, Springer. DOI: 10.1007/s12304-013-9176-6

[13] Gill, Zann. 2012. User-Driven Collaborative Intelligence: Social Networks as Crowdsourcing Ecosystems. ACM CHI (Computer Human Interaction). May 5 – 10, 2012. Austin Texas.

[14] Michael Quinn. 2016. Jeremy Bentham, 'The Psychology of Economic Man', and Behavioural Economics Jeremy Bentham, 'The Psychology of Economic Man', et l'économie comportementale.
p. 3-32. https://journals.openedition.org/oeconomia/2249?lang=en

[15] Escamilla, Manuel. 2008. Rights and Utilitarianism. John Stuart Mill's Role in its history. Revue d'etudes Benthamiennes. 4 |: Spécial John Stuart Mill Dossier.https://journals.openedition.org/etudes-benthamiennes/192

[16] Harris, Tristan. May 18, 2016. How Technology is Hijacking Your Mind—from a Magician and Google Design Ethicist**.** https://medium.com/thrive-global/how-technology-hijacks-peoples-minds-from-a-magician-and-google-s-design-ethicist-56d62ef5edf3

[17] Drummond Reid. Decentralized Identifiers. May 7, 2018. https://youtu.be/Jcfy9wd5bZI SSI Webinar.

[18] Anonymous. Incentive Fundamentals for a Token Economy. June 25, 2018.
https://medium.com/coinmonks/incentive-fundamentals-for-a-token-economy-3f161ac04ac4

[19] Sun, R, N Wilson, M Lynch. 2016. Emotion: a unified mechanistic interpretation from a cognitive architecture Cognitive Computation 8 (1), 1-14.

[20] Hogg, Tad, Szabo, Gabo. 2008. Diversity of online community activities. In: Proceedings of the Nineteenth ACM Conference on Hypertext and Hypermedia. 2008. pp. 227-228. http://doi.acm.org/10.1145/1379092.1379138

[21] Martins Bratuskins. Dec 1, 2017. The Impact of Digital Technology on Gaming
https://medium.com/monetizr/the-benefits-of-tokenization-for-gaming-54ea600540f0

[22] Gill, Zann. 2011. Collaborative Intelligence and Effective Complexity. ICCS 2011 (International Conference on Complex Systems). June 26 – 30. Boston, MA.

[23] Ryan-Collins, Josh. 2010. Not so "Mickey Mouse": Lessons in the nature of modern money from complementary monetary innovations. Journal of Economic Sociology. The European electronic newsletter [ISSN:] 1871-3351 v.12. 2010. 1. pp. 58-67. https://www.econstor.eu/handle/10419/155962

[24] Lerman, Kristina and Tad Hogg. 2010. "Using a model of social dynamics to predict popularity of news. Proceedings of the 19th Conference of the World Wide Web. ACM. P. 621-30. http://doi.acm.org/10.1145/1772690.1772754

[25] Milinski, M. 2015. Reputation, a universal currency for human social interactions. Philos Trans R Soc Lond B Biol Sci. Feb 5;371(1687):20150100. doi: 10.1098/rstb.2015.0100.https://www.ncbi.nlm.nih.gov/pubmed/26729939

[26] Lietaer, Bernard, Jacqui Dunne. 2013. Rethinking Money: How New Currencies Turn Scarcity into Prosperity. San Francisco, Berrett-Koehler Publishers. Roz Savage. May 17, 2018. Rethinking Money.
https://www.rozsavage.com/rethinking-money/

[27] van der Linden, Martijn Jeroen & Cees van Beers. 23 Aug 2017. Are Private (Digital) Moneys (Disruptive) Social Innovations? An Exploration of Different Designs. Journal of Social Entrepreneurship. Volume 8, 2017 - Issue 3: Social Innovation to Address Marginalisation: Insights from European Cases. pp 302-319. https://www.tandfonline.com/doi/full/10.1080/19420676.2017.1364287.
di Massimo, Amato, Luca Fantacci. 2016. Per un pugno di bitcoin. Rischi e opportunità delle monete virtuali. Università Boccone.

[28] Brooks, JD, N Wilson, R Sun. 2012. The effects of performance motivation: A computational exploration of a dynamic decision making task. Proceedings of the First International Conference on Brain-Mind, p. 7-14.

[29] Brzozowski, Michael J., Hogg, Tad, Szabo, Gabor. 2008. Friends and foes: ideological social networking. In: Proceedings of ACM CHI 2008 Conference on Human Factors in Computing Systems April 5-10, 2008. pp. 817-820. http://doi.acm.org/10.1145/1357054.1357183

[30] Klein, Joshua. 2018. How Reputation became the new Digital Currency.
https://designtoimprovelife.dk/how-reputation-became-the-new-digital-currency/