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When my wallet is connected to your wallet, something in its nature must change. [...] In 10 years' time, my smart wallet and your smart wallet are going to be talking to each other and we won't be in the loop so much, we won't be bothered.

—David Birch<sup>1</sup>

Eighteenth century literature was rife with stories of dumb, inanimate things: the inner life of a corkscrew, the hidden desires of a top hat, a day in the life of a watch, what the kite saw or the pin overheard. A subset of these 'it narratives', as they were called, concerned the secret lives of monetary tokens, with fictions tracing the circuitous journeys of paper banknotes and the people they encountered. Mary Poovey observes how the 'talking note' illuminated the various social contracts and encounters that took place in economic exchanges at the time.<sup>2</sup> Popular accounts were Thomas Bridge's *Adventures of a Bank Note* (1759-1775),<sup>3</sup> and Charles Johnstone's *Chrysal; or, the Adventures of a Guinea* (1760-1765).<sup>4</sup> *Chrysal* tells his reader of the moment he was forged in a mine in Peru and the stories of who and what he encountered as he was passed from hand to hand. Talking notes betray the idea that the stuff of transactions was animate or sentient, more than a 'dumb, lifeless prop' in exchange. These things didn't just serve the wishes of their immediate possessors: they were agents in their own right, they had wants and desires; they spurred action as they met and interacted with other stuff; they observed and recorded everything they came into contact with; and they might just as easily betray or 'tattle' on their owners.

Things have always intervened in the construction of markets. They transact, trade, intervene, monitor, calculate, circulate and abstract. As Viviana Zelizer<sup>5</sup> and more recently Bill Maurer and Lana Swartz have explored,<sup>6</sup> economic mediation is composed of tons of different stuff, from paper tokens and coins, to checks, promissory notes, tallies, dongles, plastic, and electrical impulses. Things are always already 'market devices', part and parcel of the material-discursive assemblages that shape the economy.<sup>7</sup> But today our things are really taking a front seat in economic exchange. The

1 David Birch, cited in Bill Maurer, 'Late to the Party: Debt and Data', *Social anthropology* 20.4 (2012): 474-481.

2 Mary Poovey, *Genres of the Credit Economy*, London: University of Chicago, 2008, p. 148.

3 Thomas Bridge, *Adventures of a Bank Note*, New York, NY: Garland Pub., 1759-1775.

4 Charles Johnstone, *Chrysal; or, the Adventures of a Guinea*, London: Printed for T. Becket, 1760-1765.

5 Viviana A. Rotman Zelizer, *The Social Meaning of Money*, London: Princeton University Press, 1997.

6 Bill Maurer and Lana Swartz (eds), *Paid, Tales of Dongles, Checks and Other Money Stuff*, Boston, MA: MIT Press, 2017.

7 Fabian Muniesa, Yuval Millo, and Michel Callon, 'An Introduction to Market Devices'. *The Sociological Review* 55.2 (2007): 1-12.

OECD currently estimates some 25 billion connected things will be online by 2020.<sup>8</sup> One application of these devices is for mobile or ‘ambient’ payments, with the option to pay for things using things beyond the usual credit card or checkbook — with iPhones and FitBits, cars, fridges, cameras and shoes coming to the register.

This short piece is a call to recognize connected things not only as politically animate, participating in the shaping of discourses and action, as new materialists have been arguing for a while, but also to think of these connected things as *economic* actors that play a role in the shaping of market elements such as exchange, price, the production and circulation of goods, and relations of debt and credit. With the proliferation of the ‘its that transact’, we can begin to ask: How will markets transform as connected things proliferate and come to the fore of exchange? What does it mean for things, not just humans, to exchange and transact? How does their appearance in the marketplace intensify trends towards algorithmic and data-driven market decisions? For example, how will things negotiate the construction of credit, risk and price? Or will people trust their personal objects to perform transactions on their behalf?

### **Our Objects are Playing a Greater Role in Exchange and Will Continue to Do So in the Future.**

Much like the rise of ubiquitous computing and promised invisible computation,<sup>9</sup> talk today of ‘seamless’, friction-free, and ambient commerce promises that, with the rise of an Internet of Things (IoT), the messiness of exchange will fade into the background. No more fumbling in your pocket for the right coins as your car approaches the toll-booth, or standing in-line to make inane chitchat with the cashier about how well that dress will suit you. Intelligent things will come to the fore of the market, transacting, abstracting and calculating on behalf or even independently of human users. This intervention doesn’t only occur at the point of sale, with the wrist tap, or an authoritative nod from an RFID or Bluetooth enabled device, but all throughout the market.

Connected things increasingly mediate transactions, either on behalf of their users or off their own bat in what are sometimes called machine-to-machine (M2M) payments. We are probably already familiar with instances of these — the growth of contactless payments, e-tolls that automatically pay for motorway use and the development of Amazon Dash buttons being a few examples. Phones, watches and FitBits also authorize in-store purchases; household utensils and white goods stock up on everyday essentials; vehicles invisibly transact in fuel, parking spaces and repairs; smart grids and infrastructures purchase and exchange energy resources and data or engage in carbon trading.<sup>10</sup> When things come to the fore of the market they produce new kinds of money and new payment infrastructures, but also potentially a whole new understanding of the sociality of exchange — how ‘its’ transact, negotiate, barter and

8 Organisation for Economic Co-operation and Development, Working Party On Communication Infrastructures And Services Policy, ‘The Internet Of Things: Seizing The Benefits And Addressing The Challenges’, Background Report For Ministerial Panel 2.2, [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP\(2015\)3/FINAL&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP(2015)3/FINAL&docLanguage=En).

9 See for example, Mark Weiser’s ‘The Computer for the 21st Century’, *Scientific American* 265.3 (1991): 94-104.

10 Initiatives such as the Visa Ready Program exist to integrate tokenised/secure payments into a range of everyday wireless objects in collaboration with hardware manufacturers and retailers.

settle, and the norms, practices and protocols that develop around these activities. What does the kettle desire? What did the fridge buy from the breast pump? What is your toaster saying about your credit worthiness?

Most human-to-human transactions are structured by legal and social norms (such as those around bargaining, haggling, and the construction of price), mediated by tokens like paper money and credit cards, and supported by age-old institutions such as banks that allow the rest of us to cooperate and transact with people we don't know. In the future, transactions between humans and things and between things and other things may largely be structured by software-defined rules. Many technologists already propose the use of *smart contracts*,<sup>11</sup> not only as a way of securing data produced by so many connected devices against hacking or government surveillance,<sup>12</sup> but also as a means to automate trades and transactions between things and other things. Smart contracts recorded on the blockchain and designed to automatically execute conditions for the use and transfer of property rights would allow objects connected to the Internet of Things (cars, houses, energy infrastructures and so on) to be sold or leased in pre-defined ways, or so the argument goes. Imagine a self-driving car that can be rented, paid for with personal data from a phone or wearable, opened with a smart key, and which stores some of its profits away in order to pay for fuel, repairs and parking spaces, all according to pre-ordained rules.

Autonomous machine-to-machine transactions raise questions not only about security, as seen with the recent DDoS attacks mobilized by printers and baby monitors,<sup>13</sup> but also about cultures of exchange: Who wants transactions to be invisible or just 'fade into the background'? And how might the material or psychosocial attachments people have with their possessions shape the nature of these transactions? Does your weighing scales or your wardrobe mirror put you in the mood to shop? Are you more likely to trust your fridge to authorize a transaction over your necklace, or your car?

### Things Will Transform and Produce New Markets

Another recent trend has been for material things to trade in the leftover capacities they produce, such as energy, excess computer processing units, spare bandwidth, or access to whatever utility or service they produce. In 2016, the Industry conference Money 2020 placed emphasis on how the Internet of Things might facilitate markets in this *material latency* a trend already rife in the sharing economy, where owners can trade the leftover capacities in their cars with taxi services, spare rooms in their hous-

11 Smart contracts are contracts that are recorded on the blockchain and designed to automatically execute predefined rules for the use and transfer of property.

12 Paul Brody and Pureswaran Veena. 'Device Democracy: Saving the Future of the Internet of Things', *IBM*, (September 2014).

13 On 21 October 2016, the Mirai botnet was used to coordinate a global DDoS attack on Dyn, a cloud based internet performance management company, resulting in outages for Airbnb, HPQ, the Guardian, Visa, Xbox Live, Twitter, Amazon and many more. What was significant about this attack was that the hackers targeted not personal computers in the sense many of us would understand it, but a host of seemingly innocuous devices – printers, baby monitors, IP cameras and digital video recorders. The botnet targeted IoT devices that were protected by little more than factory-default passwords, gained access and enlisted these objects in coordinated attacks on major internet platforms. It felt like Revenge of the Domestic Devices. This brings to the fore questions about the dangers of IoT infrastructure, namely regarding security and encryption, questions that become even more significant where transactional data is involved.

es, or even their spare time. But with many networked devices transacting, as the new imaginary goes, a thing might trade equity in just about *any* ‘thing’ for anything else. Imagine, for example, an umbrella that sold shares itself whenever it rained — not too farfetched in China, where umbrella rental is already up and running — or an Airbnb style property with a fluctuating rental price that in turn speculated and purchased shares in profitable start-up companies nearby. ‘Its that transact’ imagines a kind of fluidity to connected things, that our leftover stuff might shake off their material casings and whatever makes them unwieldy or ‘lumpy’, as Yochai Benkler puts it (2004), and become instead pure value or information — the ingredients of an on-demand economy with a place for everything and everything in its place.

Money-like things, as Chrysal the guinea observed, have the peculiar ‘power of entering into the hearts of their immediate possessors and there reading all the secrets of their lives’.<sup>14</sup> ‘It narratives’ were constructed around the idea that if only the coin could speak, oh, the stories it might tell! With connected devices, things now trade in what they’ve seen and where they’ve been. As well as transacting in and with other stuff, connected devices are developing techniques for negotiating the sale or barter of the data that they gather about their use, their users, and their broader environments. These see complex ‘data markets’ assembling around connected devices, as networked objects develop new protocols and practices to appraise and autonomously exchange the material they gather from relational entanglements. Data becomes a currency that can be exchanged for goods and services or for other kinds of data sets. Complex matching systems have to be developed to evaluate and price this data and make it transferrable. Sometimes this data is traded, or it is sold or it gets turned into other kinds of value such as fiat money, airtime, or loyalty points. A washing machine, a water meter and a filtration system might enter into a market relationship about the exchange of water consumption data, for example. A self-tracking fitness wearable, a fridge, 0% fat yoghurt and an online retailer might transact in relevant behavioral and transactional data in exchange for rewards such as loyalty points or coupons. If we are already familiar with the ‘fridge-buys-milk’ vignette of the Internet of Things, here a connected fridge might trade data about its user’s grocery consumption with a retailer in exchange for discounts on future food purchases.

### **Connected Objects Also Intervene in Calculation and Abstraction.**

Smart devices will define and intervene in the formation of prices and in the construction of financial instruments such as credit and risk. Our things are learning to keep account. We are probably already familiar with the ways in which algorithmic devices such as high-frequency trading and pricing algorithms are reshaping markets, as well as the ways in which this can go very wrong (see, for example the Flash Crash of 2010 and the inconsistencies with Berkshire Hathaway stock), but now our smart things and their datasets, will also intervene. Though still very much a prospective practice,<sup>15</sup> data gleaned from connected things, particularly self-tracking data from wearables and household devices, might soon play a role in the pricing of health insurance premiums. The use of wearables for personalized in-

<sup>14</sup> Johnstone, *op.cit.*, (1760), p. 3.

<sup>15</sup> Liz McFall, ‘The Politics of Personalised Insurance Pricing in the Age of Wearable Devices’, Draft Paper, 2017.

insurance not only produces data that can precision risk but it also has the recursive effect of shaping its owners' behavior, enabling these companies to optimize the ways humans exercise or eat, have sex and shop.

An Internet of connected Things will also contribute to the calculation of credit. The secret patterns and social life of our things may now determine our eligibility for a mortgage or loan. Mobile phone, transactional and social network data already play a significant role in credit for the 'underbanked', with companies such as Zest Finance and Kreditech offering loans based on multiple networked data points gleaned from mobile payments, device usage and social media. Connected things such as cars, wearables and household devices now also provide a greater degree of data monitoring that can be used to produce credit offerings based on social graphs, biometric data or on logistical data provided by an Internet of Things. Kabbage, one such company that specializes in small loans for SMEs, makes use of over 5,000 data points from each loan applicant, including their existing credit data and mobile phone data, but also data gleaned from commercial vehicles, GPS logs, the manufacturing of goods, return rates, and supply chains, to determine the conditions of a loan.

### **How Might Things Fight Back?**

Today connected things play a role in the transfer and circulation of property, in the construction of prices and evaluation, and in how credit and risk are calculated and apportioned. When things begin to transact with one another, when they become economic actors, we should think about the implications this has for the future of markets. Arguably what's new here is the peculiar materiality of these things and their intimate connections with people, not just that they represent an intensification of algorithmic governance in market processes.

As things get more lively, and as a vast range of data-gathering things proliferate around everyday users and their transactions, markets are becoming more dynamic but also harder to read and unpick. This is a question not only of how algorithmic governance and big data will shape the future of markets, but also how various material cultures will play a role in shaping the economy going forward. Things are not just more of the stuff of software or data repositories; they are also lively objects with their own psychosocial narratives.<sup>16</sup> In other words, it's not only the status of the thing as a market device with computational and networked capacity that might be significant in the future, but also its own peculiar material culture and people's relationship and attachment to it.

If the Internet of Things becomes central to payments we will also become more entangled with our things and entangled with markets. Much like other algorithmic market devices such as high-frequency trading algorithms and online pricing mechanisms, things are now 'designed to detect and respond [not only to the rhythms of their users and their everyday interactions, but also] to market rhythms'.<sup>17</sup> The sociality of exchange now includes the social lives of many non-human things and

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16 Anthony Dunne, *Hertzian Tales*, London: MIT Press, 1999.

17 Christian Borch, Kristian Bondo Hansen, and Ann-Christina Lange, 'Markets, Bodies, and Rhythms: A Rhythmanalysis of Financial Markets from Open-Outcry Trading to High-Frequency Trading', *Environment and Planning D: Society and Space* 33.6 (2015): 1080-1097.

their protocols and proclivities. Arguably this makes it very difficult for humans or users embedded in these systems to disentangle themselves or 'opt out' of a financial system, if such a thing were ever possible.

Mackenzie et al. call for us to consider the materiality of markets: their physical, technological and corporeal nature.<sup>18</sup> In Mackenzie's case this concerns how physical geography, distance and the materiality of wired signals help to construct prices. With the growth of things that transact, we should consider how the material specificity of our connected devices might come to shape and intervene in markets. We need to think about the socio-economic life of these actors as they enact exchanges, as they 'detach things from other things and attach them to other things'.<sup>19</sup> How might fluctuations in temperature and bacterial organisms shape the ways in which fridges transact, or environmental conditions transform the specifics of rental markets? How might our smart cars drive speculation over fuel up or down? How do objects work alongside humans, exerting influence on our moods, decisions and dispositions?

How might things begin to fight back? Equally important, we might start to think about how objects might frustrate or resist commodification in a market. Tales of IoT hacks, as well as playful findings like @internetofshit, open up an imaginary for a kind of economic resistance that might be specifically non-human in nature. Like the household devices that double-crossed their owners in the Mirai Botnet attack, objects might fight back, changing cultures of exchange or resisting altogether. We should consider the ways in which objects — commodities, minerals, metals, plastics, sensors and actuators — might not only impede the will of *homo economicus* but act out economic trajectories, behaviors and 'desires' of their own.

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