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## **1 Introduction: Infrastructuring Value**

Exploring infrastructures has much to offer for economic anthropology. Bringing together converging literatures on value and infrastructure, we develop the new analytical lens of 'infrastructures of value' on old terrain: agriculture. This connects otherwise partitioned visions that focused either on production, exchange, or consumption. Infrastructure not only undergirds valuation practices and enables valorisation as fixed capital. It also fills a major gap in David Graeber's theory of value by directing attention to how actions become incorporated into larger, social totalities. Infrastructures – material networks emerging from practices of infrastructuring – mediate value by facilitating, or hindering, the circulation of objects, people and ideas. Various types of infrastructure and the dynamics of compatibility and friction between them *shape* value by creating uniqueness for some and genericness for others. Redirecting ethnographic attention to the material relationality of value invigorates dialogue between new and historical materialism and challenges binaries in economic anthropology.

Keywords: infrastructure, valuation, financialisation, standards, singularities

In Sichuan, China, officials and peasants in Daxi Village lamented the poor state of the county-level road. It slowed down transportation and damaged fresh vegetables and fruits they hauled to consumers in town. After the road was finally reconstructed in 2015, the issue quickly receded into the background. In Arilje, Serbia, raspberry farmers complained about falling prices, as adjacent regions had started to cultivate raspberries, too. Their market entry was enabled by the cold chain (cold stores, roads and refrigerator cars) that had initially been constructed under socialism to export Arilje's raspberries.

This special issue argues that thinking with infrastructure has a lot to offer for economic anthropology, and particularly for studying value. Experienced as if beyond one's control, the materiality of infrastructure has tremendous effects on the value of goods, both in terms of quality (use-values) and quantity (exchange-value). In our cases above, a road improved market access and increased value for some farmers, but raised competition and decreased value for others. As such, infrastructures are relational and have diverging effects on different users. As material networks they combine technological, organisational and social components and emerge out of practices of infrastructuring that enlist multiple human and non-human actors. But once they are established and work relatively smoothly, infrastructures tend to fade from attention. Therefore, we argue that approaches to value, which have long suffered from partitioned visions either on production, exchange, or consumption, can profit from a turn to infrastructures, because these enable (or limit) the 'circulation'—movement and metamorphosis—of goods, people, and ideas along value chains.<sup>1</sup>

Much has been written about value, and its source particularly hotly debated. Historically, scholars have often discussed value with examples from agriculture, probably because of the materiality of food and its close connection to the environment (nature),

needs (survival), pleasures and desires (taste), and what David Graeber (2010) has called the ‘communism of the senses’, that is sharing and commensality. On this old terrain of food and farming, this special issue develops infrastructure as a new lens for exploring value.

Anthropologists have used infrastructure mainly to push debates in political anthropology. Yet, we have noticed nascent convergences between studies of value and infrastructure in ethnographies of finance that foreground the irreducible materiality of seemingly immaterial value. But convergence does not necessarily mean agreement. Informed by either new materialism or historical materialism, these ethnographies have different conceptual and empirical starting points and pull in opposing directions. Rather than picking one side, we found it more productive to take inspiration from both to open up a new field for ethnographic theorisations of value. We have also selectively drawn on science and technology studies (STS), history, geography, and political science for our anthropological exploration of *infrastructures of value*. Our aim is to initiate conversation and strengthen the mutual entanglement of thus far largely unrelated literatures, thereby making them productive for economic anthropology.

It is perhaps no big surprise that these recent convergences started in finance, given that money has been regarded as the most generic form of value and that infrastructures are usually associated with standardisation. Yet, the exclusive focus on financial value and genericness is limiting their potential for an anthropological theory of value. Working our way through the diversity of the agricultural sector and the multi-faceted materiality of food has allowed us to chase and polish the lens of *infrastructures of value* by considering the dialectics of genericness and uniqueness.

At first glance, agriculture and finance may appear as worlds apart, the former close to ‘nature’, the latter distant to it. Yet, in certain cases the connections between farming and finance have become empirically obvious, such as in food speculation or farmland financialisation (author2, this issue). An opposing trend has been the proliferation of food movements (author6, this issue) and specialty foods (author3, author5, author4, author7, all this issue). Against the prevalent tendency to explore these trends separately and with different methodologies and concepts ([author6] 2017: 6),<sup>2</sup> the lens of infrastructure allows us to move beyond presupposed difference and to reconnect seemingly generic financial value with seemingly unique food values. We argue that both standardisation and singularisation of agri-food and farmland require infrastructures that relate selected units to each other to render either their similarity or difference relevant. Turning the lens of infrastructure from finance to food and farming spotlights the dynamics between diverse types of infrastructure and value.

We suggest that infrastructure closes a significant gap in the most ambitious formulation of an anthropological theory of value. David Graeber’s (2001) aspiration was to unite different treatments of seemingly different forms of value. Building on anthropologist Terence Turner’s (1984; 2008) reading of Marxian labour theory of value and Nancy Munn’s (1986) restudy of the famous Kula ring, he identified creative activity as the common basis of all value. For Graeber (2001: xii), value is ‘the way in which actions become meaningful to the actor by being incorporated in some larger, social totality—even if in many cases the totality in question exists primarily in the actor’s imagination.’ To move another step toward an anthropological theory of value, we need to unpack what remains largely black-boxed by Graeber or what he opaquely attributes to individual imagination: how the link between a person’s action and some larger totality is

established. As material networks, infrastructures offer a privileged vantage point to understand these incorporations.

Infrastructures of value spotlight the inseparability of processes of production, exchange and consumption. Various infrastructures of transportation, containment, information, law and science (and probably others we do not yet cover) all shape value through material creations and destructions of uniqueness and genericness. This propels dynamics between monopoly and open market, niche and mass markets, cooperation and competition. Highlighting infrastructures of value as the common ground of processes that are usually assumed to be opposites challenges persistent binaries and often claimed ruptures in economic anthropology: artisan versus industrial production, gift versus commodity exchange, capitalism versus socialism, community versus market.

We begin to sketch our approach to infrastructures of value by spotlighting, first, convergences of studies of value and infrastructure and useful forerunners. Second, we present the collected ethnographic insights from Europe, Latin America, Asia, and Australia on how infrastructures shape the value of agricultural matter (land, wine, yeasts and soils, coffee, rice, vegetables and berries). Besides identifying four different types of infrastructures of value we stress ‘infrastructuring’, that is people building, maintaining, using, and rearranging these assemblages, as a crosscutting analytical axis. Finally, we discuss dynamics between the parts and different types of infrastructures of value, highlighting the role of scientific planning, compatibility issues and the necessity of adjustments. We conclude by observing how infrastructures of value endure and transcend supposed ruptures due to their materiality – both in the new materialist and historical materialist sense.

## **Value and Infrastructure: Convergences and Precursors**

Food and farming have long provided fertile ground for exploring value. Only agricultural labour – enabled by the productivity of the soil – was regarded by eighteenth-century French physiocrats as producing surplus value. A butcher, a baker, and a brewer bartering meat, bread, and beer served Adam Smith to tell his story about the origin of money.<sup>3</sup> A peasant who sells corn and uses the money to buy clothes served Karl Marx in the first volume of *Das Kapital* to discuss simple circulation (C – M – C) in contrast to the circulation of money as capital (M – C – M’).

In anthropology, Nancy Munn (1986) argued that the act of giving food cultivated in the gardens of Gawa Island created the fame that enabled participation in the Kula exchange of red shell-disc necklaces and white shell armbands of extraordinary value. More recently, ethnographies of specialty food and food activism have studied economic value together with a variety of social, cultural, political and moral values (Paxson 2013; Pratt & Luetchford 2014) .

Meanwhile, the study of economic value has shifted to new terrain. Especially after the stock market crash of 2008, economic anthropologists and sociologists have turned their attention to the production and creative destruction of value through finance. The social studies of finance took inspiration from STS and concentrated on accounting and valuation practices, but also the techno-scientific infrastructures that enable them.<sup>4</sup> Michel Callon (1998: 2) famously argued that ‘economics ... performs, shapes and formats the economy, rather than observing how it functions’. His notion of ‘calculative tools’ underlines that economic models and mathematical formulas do not merely observe but constitute value in practice. Studies of finance have thus shown how pricing models for derivatives (MacKenzie & Millo 2003) and risk calculations by rating agencies (Rona-Tas & Hiss

2011) make financial goods more or less valuable. With the daily routines in the world of finance, the material infrastructures that enable and constrain them also received attention (MacKenzie 2009).

Apart from this convergence of value and infrastructure in new materialist studies of finance, we also see them coming together along a very different path. Anthropologists have thus far used infrastructure to invite non-human actors into the political arena (Larkin 2013). Criticising the limits of liberalism and representative government (Venkatesan et al. 2018), they have demonstrated how infrastructure produces inclusion (Anand 2017; Kappeler 2017) or exclusion (von Schnitzler 2016; Appel 2019). However, perhaps trying to avoid ‘economic determinism’ (Buier, n.d.), the new materialist mainstream, borrowing insights from STS and actor-network theory (Star & Ruhleder 1996; Star 1999), has largely shied away from economic anthropology. Yet, a historical materialist critique has urged the anthropology of infrastructure to attend to the contemporary financialisation of infrastructures as a spatio-temporal fix to capitalist overaccumulation (Buier, n.d.; see Bear 2017; P. Harvey 2017).<sup>5</sup>

Treatments of value and infrastructure thus converge in the field of finance, but in a strikingly diverging manner. The one views infrastructure as enabling valuation practices and financial transactions; the other sees surplus value emerge as the circulation of capital passes through infrastructure as fixed capital. One can gain a lot from looking at value through infrastructure from these two very different angles. In terms of theory, valuation explores processes of classification, standardisation and the agency of non-human actors, while valorisation studies processes of power and exploitation.

Yet, having in mind our ethnographies of the two seemingly opposed trends of financialising agriculture vs. alternative food networks, we feel that there is more to

infrastructures of value than enabling either valuation or valorisation. Some precursors of infrastructures of value have nurtured our belief that a fruitful combination of old and new materialisms is possible. This synthesis would acknowledge that the actions of humans and non-humans are equally powerful, and the future radically open, but also that only a ‘bumpy’ (rather than flat) topology of infrastructures explains the emergence, ‘accretion’, and exploitation of differences and inequalities. For instance, in his historical study of the Aswan Dam, political scientist Timothy Mitchell (2002) has convincingly shown how also non-human actors (tsetse flies and dams, among others) have shaped the circulation of capital along the Nile. Meanwhile, his *Carbon Democracy* (Mitchell 2013) can be read as an extended argument about how the materiality of infrastructures has influenced the political and economic value of variable capital (labour power): different transportation infrastructures (railroads and waterways) linked to different energy sources (coal and oil) have variously helped or hindered workers’ struggles. This may dissipate worries that relating infrastructures and value necessarily ends in economic reductionism.

What has particularly drawn our attention were metamorphoses between uniqueness and genericness – a classic issue in musings on value. Not only Marx’ discussion of the double character of labour and the interplay between the use-values and exchange-value of commodities comes to mind, but also economic anthropologists’ reflections on generic commodities and unique objects such as gifts and inalienable possessions (Gregory 1982).

Long before the financial infrastructures of seemingly immaterial digital money grasped scholars attention (Bernards & Campbell-Verduyn 2019), some forerunners of our endeavour have highlighted the materiality of information infrastructure that enables the valuation of agricultural products in generic monetary terms. In the 1980s, Marie-France Garcia-Parpet (2007[1986]) studied the construction of a ‘perfect market’ for strawberries



in France. The designers of this market translated orthodox economic theory into the specific architectural layout of the auction room and used state-of-the-art digital technologies to script people as anonymous, individuated buyers and sellers that only focus on a batch's quality and price. More recently, Sarah Besky (2020: 49–73) published an insightful account of the heterodox Kolkata tea 'live outcry auctions', catalogues and archives that since the mid-19<sup>th</sup> century have functioned as a ritualised 'communicative infrastructure' for 'finding quality prices for each lot of tea' (57). Similar to Garcia-Parpet's case of the French strawberries, the financial-speculative transformation of India's tea auctions in the 21<sup>st</sup> century followed a related orthodox economic script and was again connected to the latest digital infrastructures (152–175).

Moving beyond information infrastructure, yet other precursors have demonstrated the historical interconnectedness of finance and food through other kinds of infrastructures of value and expanded on their histories of power and exploitation. Environmental historian William Cronon (1991) showed that speculation with grain futures was made possible in mid-19<sup>th</sup> century Chicago by interrelated transformations in transportation, containment and legal-scientific infrastructures. Railroads replacing the water-based transportation infrastructures required huge capital investments. To make these investments profitable required speeding up the loading process by 'getting grain out of its sacks, off the backs of individual workers'. This allowed grain to 'flow' quickly on steam-powered conveyor belts into vertical bins in multi-storeyed warehouses (111). It also meant mixing different farmers' grain and thus transforming something unique into something sorted into generic grades. This in turn meant that grain stored in grain elevators increasingly resembled gold or silver stored at a bank. In combination with novel telegraph lines and grain futures contracts emerged the speculative futures market of the Chicago Board of Trade (120–132).

Here, as in common sense, infrastructure often appears as generic and standardised and itself producing the generic through standardisation. STS has, of course, questioned any claims about infrastructures' genericness and stability, pointing to tensions between standards and their local, customised, and flexible use (Star & Ruhleder 1996). Yet, the effect of infrastructure's apparent genericness for the appropriation of value deserves more attention.

Studying US oil platforms off the shores of Equatorial Guinea as 'modular infrastructures', Hannah Appel (2019: 3, 25) has investigated 'the work required to create the "as ifs" on which capitalism has so long relied: abstraction, decontextualization, and standardization ... how things come to seem smooth, separate, distanced, and outside of local life'. While Appel (2019: 5) acknowledges that anthropology has long been 'rescuing local specificity and complexity from the abstracting distance' of capitalism, she argues that we also need to show how the genericness and abstractness of capitalist infrastructure is produced. In fact, she argues that oil companies use social scientific constructions of local uniqueness (epitomised in 'the pathological African state') to justify the export of profit by attributing efficiency and success to generic 'global' infrastructures, but failures to 'local' corruption, irregularities and indifference. Here the anthropology of infrastructure converges conceptually with social studies of finance that also highlight the performativity of the sciences and their information infrastructures in constructing markets. Yet, where social studies of finance focused on economics, Appel can be read to remind anthropologists that our own scientific endeavours – even if wary of standardisations, generalisations and abstractness – can become involved in infrastructuring capitalist profit, exactly because of claims about cultural specificity.

Thinking through our food ethnographies with the emerging *infrastructures of value*-lens, we have identified four types of infrastructures and people's infrastructuring practices that shape value in manifold ways. In addition to valorisation and valuation through infrastructure, value emerges (or vanishes) when infrastructures create (or destroy) uniqueness and genericness.

### **Infrastructures of Value: A Typology**

Before we begin to enlarge on the different types of infrastructures of value: transportation, containment, law and science, information, and people, our selection requires some explanation. This list emerged from our necessarily eclectic literature review and the collected ethnographies of food and farming. We will start with transportation infrastructure *not* because it is somehow more material or fundamental than the others,<sup>6</sup> but because it fits a more conventional understanding of infrastructure.<sup>7</sup>

Indeed, some have criticised that infrastructure has become a 'voracious concept' in anthropology (Venkatesan et al. 2018: 38). While our aim is not to engage in a debate about *what* infrastructure is or is not,<sup>8</sup> we heed warnings that infrastructure may lose its academic value if it is broadened so much that one '[ignores] some of the term's classical defining features' (Calkins & Rottenburg 2017: 254). Therefore, our contributions foreground infrastructure's 'stable materiality and the techno-scientific and political dimensions of infrastructural planning, construction and maintenance' (254).

Lists are always incomplete. There are some obvious gaps in our list, like energy infrastructures.<sup>9</sup> Others may be less obvious, like soil.<sup>10</sup> Of course, the list can and should be expanded.

### ***Transportation***

From a historical materialist perspective, investment in transport infrastructure such as high-speed railways may fix capitalist overaccumulation crises (Buier 2020). New materialists have explored the specific materiality of railways, waterways and roads. Thus, the dendritic shape of the transportation infrastructure for coal and its grid-like shape for oil have conditioned possibilities for workers' struggles and, thus, the value of labour power (Mitchell 2013: 38). In the introductory vignette, we have also hinted at how roads increase and decrease value by propelling dynamics between genericness and uniqueness, abundance and scarcity, and competition and monopoly.

Transportation infrastructure connects creative actions (and resulting products) with larger, social totalities. It shapes value by affecting just how large that relevant totality is, as author7 (this issue) shows. He follows the historical trajectory of cold chains developed under socialism for the export of Serbian raspberries. A late-socialist cooperative in Arilje innovated agronomic procedures and standards for small-scale farmers to produce high quality, highly perishable raspberries. Assembling new, more efficient transportation infrastructures – tarmac roads, refrigerated trucks, cold stores (and the energy infrastructure powering them) – allowed the deep-freezing and circulation of the raspberries to distant capitalist markets. During post-socialism, the modular shape of these transport infrastructures allowed local competitors to connect their own, replicated modules. This new competition diminished the profits of the cooperative's successors, curtailed the funding for agronomic extension work and led to decreases in raspberry quality, even if production volumes soared, thus turning a relatively rare product into a widely available, and in this sense generic, one.

These dynamics can be grasped with David Harvey (2002), who deployed the Marxian notion of monopoly rent to infrastructure. He argued that historically the lack of

transportation networks excluded distant producers from linking up with consumers and allowed close producers a unique, protected position on the market. The construction of transport infrastructure forced them into competition (97). Furthermore, he argued, new transportation infrastructure can make certain sites particularly central or accessible for consumers, recreating uniqueness of locations and monopoly rents for producers (94). But while commodification tends to destroy the unique (95), competition may propel the search for it (100). Recently, the successor enterprise of the cooperative endeavoured to recreate uniqueness by branding ‘Arlje’s raspberry’ and by scientifically innovating ‘organic’ production (on information and legal-scientific infrastructures, see below).

Author7’s study (this issue) adds to Harvey’s (2002) take on value that transportation infrastructure not only propels dynamics of uniqueness and genericness in terms of location, but also in terms of the product itself. If the cold chain does not run smoothly, high quality raspberries lump together and lose value. Transportation infrastructure may thus produce unique market positions for some or destroy them for others, either increasing prices by creating a monopoly (exclusive access or exclusive products), or decreasing prices through the intensification of competition (generalised access or mass products).

This brings us to the next type with which transportation infrastructure is closely interlinked. Raspberries need to be contained through deep-freezing infrastructures before they can be transported over longer distances without spoiling.

### ***Containment***

While processing such as deep-freezing or drying transforms the material structure of food itself to contain it, packaging at different scales works as a container by adding a separating

layer. This preserves contents from decomposition, dissolution, and fragmentation. As ‘time machines’ (Robb 2020), container technologies enable the transcendence of both time and space, enabling movement through fixing contents. Besides, containers also ‘order the world’ by materially constituting contents through separation (Robb 2018).

Container technologies are only one element of infrastructures of containment. Discussing the bottling of *vino naturale* by small-scale Italian wine producers, author4 (this issue) shows that containment infrastructures are assemblages that include containers, packaging machinery, legal regulations and stories. All these elements have to be brought into alignment for the bottle to function as infrastructure of value. This may mean physically and discursively concealing the bottling machinery and the monotonous bottling process from visitors while telling stories of fine wine produced by the figure of the Italian ‘peasant’ who wards off the ills of industrialised agriculture.

Infrastructures of containment fill the gap in Graeber’s value theory in two ways that have to do with their separating function. First, packaging in combination with cold chains maintains the ‘freshness’ of foodstuffs as they are transported from producers to consumers, thereby generating premium prices (Freidberg 2010). While fresh food may come *from anywhere*, infrastructures of containment may, second, allow the contained food or drink to move *through anywhere* – through generic space and time – while still functioning as an embodiment of a distinct place and time of origin (author4, this issue).

Although using neither the terms ‘infrastructure’ nor ‘containment’, Cronon (1991) has described how certain kinds of containers maintain or break the links of their contents to specific places. As long as grain was moved in sacks, ‘[n]othing adulterated the characteristic weight, bulk, cleanliness, purity, and flavour that marked it as the product of a particular tract of land and a particular farmer’s labor’ (Cronon 1991: 107). Grain became

a generic and ‘liquid’ object of speculation by removing the sacks and mixing different farmers’ cereal in vertical bins. By contrast, author4 (this issue) demonstrates how wine becomes a ‘solid’, unique object of high value by using bottles as containers. He argues that the rich literature on the valuation of wine, particularly on ‘terroir’, lacks consideration of the material-infrastructure basis that makes the manifestation of singularity both recognisable and socially significant.

But Cronon’s sacks of grain included a bill of lading in the inside and author4’s bottles had labels glued on their outside. With other words, containment and information infrastructures collaborate to speak about the provenance of their contents.

### ***Information***

David Harvey (2002) has argued that monopoly rent can also be achieved discursively through ‘uniqueness claims’ (99) or ‘monopoly claims’ (100). Such claims materialise on labels that communicate product names, logos, brands, regional appellations, fair trade seals, organic certifications, rankings, nutritional specifications and so on. As information infrastructure, labels enable the circulation of ideas by relating unique products to generic standards. This links individual with larger whole and affects value.

Proponents have described labels as a ‘knowledge fix’ that bridges an information gap between producers and consumers to help consumers make informed choices and producers reap premiums. But critics have argued that labels, conceptualised as ‘boundary objects’ (Star & Griesemer 1989) both black-box complex processes ‘into a single, immediately recognizable logo or word that can travel with the product across time and space’ and enable heterogeneous and flexible interpretation in different epistemic communities (Eden 2011: 192). Granting them an even more active role, labels as

‘judgment device’ (Karpik 2010) not only provide ‘oriented knowledge’ for consumers, but also shape consumer tastes. As such, judgment devices ‘*qualify simultaneously both product and client*’ and thus frame ‘markets of singularities’ (Karpik 2010: 51, emphasis in original). Conceptualised as ‘information infrastructure’ (Bowker et al. 2010), ‘labels are performative and markets [or rather producers] will react to make foods perform what is on the label’ (Frohlich 2017: 150, parentheses added).

However, the economics of labels works through various interplays of uniqueness and genericness. Key to these processes is the standardisation of either food itself or the information about it. First, based on certain standardised product categories, labels may visualise that food is generic or disclose specific contents as unique in relation to standardised formulas. Labelling the unique, for instance plastered, raisin or sugar wine as ‘innovation’, makes it valuable by creating a niche market apart from the mass market of the generic product category. Meanwhile, labelling against ‘adulteration’ renders the unique valueless, limits market competition and preserves the value of the generic product (Stanziani 2007).

Second, when standardisation shifts from food to information, value struggles shift from measures against ‘adulterating’ food to measures against ‘counterfeiting’ labels. Packaging materials of famous brands or quality labels may, for example, include ‘laser-burned lot numbers and specialized anti-counterfeit labels’ (Lin 2011: 32). This exposes the materiality of information infrastructures and the efforts that go into labelling and counterfeiting. Author6 (this issue, see also 2018) has observed that even existing labels of correctly certified organic products may be concealed to generate value. Given the discourses about ‘corruption’ and counterfeit organic products in China, the rice of the Daxi



peasant cooperative was displayed in certain situations without label to appear more trustworthy and valuable than generic state-certified, ‘value-added’ rice.

Thus, information infrastructures enable the circulation of ideas about unique and generic products through relating individual creations through standards to larger totalities, thereby shaping value. Both in their non-human or human materiality (see the section on people below) they coevolve with legal and scientific constructions of facts about uniqueness and genericness.

### ***Law and science***

In the third volume of *Capital*, Karl Marx (who inherited the family’s vineyard) built on his familiarity with the vintners of Germany’s Mosel Valley to explain his concept of monopoly rent:

A vineyard producing wine of very extraordinary quality which can be produced only in relatively small quantities yields a monopoly price ... This surplus-profit, which accrues from a monopoly price, is converted into rent and in this form falls into the lap of the landlord, thanks to his title to this piece of the globe endowed with singular properties. (Marx 2010a [1894]: 566)

For Marx, it appears, uniqueness was given by the specific qualities of the land monopolised by private property holders. Although he was aware that ‘the discovery of the different aspects of things and therefore of their manifold uses is a historical deed’ (Marx 2010b: 4),<sup>11</sup> Marx did not pursue this issue in any depth. With legal-scientific infrastructures, we draw new attention to the work involved in and value produced by evidencing both uniqueness and genericness.

We build on studies that have highlighted links between law, science, materiality and value (B. Turner 2016). If infrastructure is an ‘embodiment of standards’ (Star 1999:

381), legal-scientific standards are also ‘disembodied infrastructure’. Several authors have shown that international food standards are designed based on existing material infrastructures of some producers, thereby excluding others who cannot invest enough to achieve adjustment (Dunn 2003; Gille 2016). The appropriation of value through the interplay of science and law has also already received attention in the case of patenting in the agri-food sector (Müller 2014; Aistara 2018: 185–211).

Sociologists of worth can help understand these operations of legal-scientific infrastructures. Luc Boltanski and Laurent Thévenot (2006) have examined how worth emerges as ‘particular beings’ are related to ‘forms of generality’. While they have studied standardizing operations of ‘qualification’, Lucien Karpik (2010: 54) has studied singularising qualifications. Legal and scientific infrastructures of value thus perform the dialectics of qualification by establishing difference (particularity) and equivalence (generality) of beings.

*In the differentiating mode*, legal-scientific infrastructures evidence particular use-value by making the part in relation to the whole unique, trying to evade competition and create monopoly. Author3 (this issue) discusses how two related legal-scientific infrastructures of value – soil mapping and local yeast selection – are employed by a Moldovan wine-growing estate to create its unique *terroir* to achieve the internationally coveted Protected Designation of Origin (PDO) status (Demossier 2018). In this process, the selected unique ‘wild’ yeasts are reproduced in a standardised manner. Uniqueness and genericness are therefore not in a dichotomous opposition, but produced alongside each other. Yet, in the case of the generic reproduction of particular yeasts, huge investments in technologies and production facilities are needed. Therefore, ‘local’ yeast could only be produced in western countries where production costs are higher. This exposes how

economic inequalities intervene in the institutionalisation of authenticity (author3, this issue).

*In the equivalising mode*, legal-scientific infrastructures may not only evidence generic use-value (e.g. proofs against adulteration), but also exchange-value. By making the part in relation to the whole generic, they can produce proof of the possibility of valorisation of agriculture as fixed capital. In the footsteps of the social studies of finance, author2 (this issue) follows how scientific infrastructures turn farmland into a financialised asset in Australia. Through the use of satellite images, mathematical formulas, economic theories, and models of visualisation, sets of data concerning tracts of land are produced and rendered into generic imaginations of future financial value. Going beyond a focus on valuation methodologies and data bases, author2 also shows that, as in earlier struggles about land, scientific abstractions and simplifications reshape the natural space that they purport to measure (Scott 1998). Without material adjustments such as digital infrastructures and new irrigation infrastructures, land is not of little, but simply of no value for financial investors who are looking for steady income streams.

In sum, legal and scientific infrastructures make agri-food and land valuable by defining the relation between part and whole. Highlighting certain features as generic and others as unique, they include some beings as commensurable and exclude others as incommensurable.

### ***People***

The four types of infrastructures discussed so far (transportation, containment, information, legal-scientific) are often thought to be stable (associated with materiality) and generic (associated with standards). People are often understood to be the exact opposite: flexible

and unique. However, both STS and anthropological studies have stressed the relational and processual character of infrastructures.

For Susan Star (1999), Geoffrey Bowker and colleagues (2010), infrastructure includes besides technologies also organisations and humans. Therefore, ‘infrastructure appears as a relational property, not as a thing stripped of use’ (Star & Ruhleder 1996: 113). The term ‘infrastructuring’ shifts our attention to ‘situated practices of infrastructure making’ (Blok, Nakazora & Winthereik 2016: 2). The practices of installing, coordinating, maintaining, and appropriating infrastructures can become so prevalent that some have even argued for conceptualising ‘people as infrastructure’, especially where material infrastructures are experienced as missing, weak, or dangerous (Simone 2004; Elyachar 2014; Calkins in print).

With the fast deterioration of the material elements of infrastructure comes the need for tinkering with them. Moreover, under competitive market capitalism, where surplus profit derives from growth and innovation, ‘moral depreciation’ (Marx 2015 [1867]: 277) of infrastructure – the loss of exchange-value due to either cheaper or better constant capital on the market – is often more acute than its material wear and tear. As [author7] (2019) has shown, small-scale Serbian dairy farmers with their old tractors and stables can only compete under global conditions of falling raw milk prices, if they constantly repair and selectively upgrade their farm equipment and enact ‘moral appreciation’: ‘affectively’ (loving repairs of even obsolete equipment for its memetic value); ‘ethically’ (inviting neighbours to perform rural belonging through agricultural work exchanges); and ‘relationally’ (revaluing dairying as stewardship of the landscape and caring for animals, friends and family).

In the ethnographic cases discussed in this special issue, people – besides material elements – are also central to the different types of infrastructures shaping value. Thus, a flying winemaker with supposedly unique skills collaborated with Moldavian food engineers to make their wine production palatable to ‘global’ trends in taste (author3, this issue), and agronomists and cold chain technologists collaborated and competed in scientifically infrastructuring Serbian raspberry production for export (author7, this issue).

But people may also refuse to become infrastructure. For instance, nine out of ten Serbian dairy farmers stopped cattle rearing within the last fifteen years ([author7] 2019). The concept of ‘people as infrastructure’ therefore risks to become meaningless when people are regarded as always infrastructuring value. Instead, it is necessary to specify *when* and *how* people become infrastructure in valuation processes. We have already mentioned that existing labels of certified organic rice were made invisible in a food network in China. Nevertheless, the cooperative received a price premium for its ‘ecological’ products. In this case, people substituted state-backed organic certification for information infrastructure. However, author6 (this issue) argues that they did so not as unique individuals ‘spontaneously’ organising into networks as ‘judgement devices’ (Karpik 2010: 45). Rather, they performed an image of personal relatedness as part of globally ‘travelling models’ (Behrends, Rottenburg & Park 2014) of alternative food initiatives.<sup>12</sup> Informed by social science concepts, personal relations had been designed as a generic counter-image to the capitalist food system. Understanding people as information infrastructure, author6 questions persistent dichotomies between ‘conventional’ and ‘alternative’ food systems by drawing attention not only to the materiality that enables and constrains the flow of information but also to the work of social scientists involved in designing infrastructure.

This brings us full-circle to the performative role of the sciences as key feature in the convergence of finance and infrastructure studies. Turning from finance to food shows that not only natural sciences and economics, but also social sciences are involved in engineering infrastructures of value (both in capitalist and alternative projects). We thus also need to look at our own discipline as infrastructuring value.

Having outlined our typology of infrastructures that configure value by connecting (transportation), separating (containment), communicating (information), evidencing (law and science) and infrastructuring (people), we can now turn to the dynamics between them.

### **Dynamics of Infrastructures of Value**

As infrastructures have reach and scope beyond a single event or location (Star 1999: 381), they direct our attention to their stable materiality, but also to their scientific planning, construction and maintenance (Calkins & Rottenburg 2017: 254). The special issue's contributions therefore spotlight the role of economists (author2), soil scientists, biologists and oenologists (author3), logisticians (author4), social scientists (author6), agronomists (author5, author6, author7) and cold store technologists (author7) in designing the larger totality.

Our authors also put relatively durable material structures centre stage: databases of sales that feed valuation methodologies to calculate the value of land (author2); laboratories that evidence the terroir of wine (author3); bottling machinery, pallets, boxes and bottles that contain fine wine (author4); the Green revolution that prepared 'nature' for both commodity grade and specialty coffee (author5); paved roads and paths that let urban middle-class consumers travel comfortably to visit ecological villages (author6); or cold chains that preserve the quality of easily perishable raspberries (author7).

The contributions further explore the materiality of value in terms of both historical and new materialism. In the historical materialist vein, infrastructures of value do not function independently of collective and private property regimes (author3, author7) and articulate different modes of production (author6). Infrastructure installed under socialism became the base of capitalist raspberry production (author7), while the costs of fixed and variable capital enable or constrain the use of certain new infrastructures (author4, author5). Finally, global overaccumulation of capital affects local valuation methodologies (author2).

In terms of new materialism, different acting entities take centre stage in our articles: the material properties of certain crops enable (author6) or require (author7) the use of certain infrastructures; material adjustments become necessary to make land legible for new valuation technologies (author2); ‘wild’ yeasts emerge through the interaction between biologists and fermented juice (author3); the liquidity of wine requires containers to stabilize it enough for moving through time and space (author4); landscapes enable or restrain the use of machinery (author5).

Infrastructure thus substantiates Graeber’s value theory by showing that the relevant totality against which the importance of one’s creative action is measured exists not merely in ‘individual imagination’. In Australia, newly globalising financial investors shake the established scales of the relevant social totality for farmland valuation – formerly undergirded by databases of local, regional and national sales – through new comparisons with transactions much further afield (author2). In Moldova, the Purcari winery taps into the global market for terroir as the relevant totality by using legal-scientific infrastructures initially developed for French wine and now adjusted to evidence unique features of soil and yeasts in Moldova (author3). While a *damigiana* (a huge glass container of about 50 litres) used as infrastructure of containment allows wine from *somewhere* to travel only

within the local community, a bottle propels it far beyond through the non-places of global logistics (author4). The dendritic shape of roads and cold chains allows producers to connect with, and alternatively compete for, consumers (author6, author7).

As infrastructures of value are ‘built on an installed base’ (Star 1999: 382), they can endure and transcend supposed ruptures (von Schnitzler 2016). Infrastructures of containment and transportation like the cold chains for raspberries have persisted beyond the end of the cold war and continued shaping value in capitalism (author7). Despite these continuities, socialist infrastructures may be downplayed by various technoscientific actors such as flying wine makers, plant engineers, biologists and advertisers who alternatively valorise post-socialist innovation and pre-socialist heritage in wine making (author3). Certain infrastructures of wine and coffee production also continue to be used when the projects of producers and traders shift from quantity to quality in order to serve niche rather than mass markets (author5, author4).

Moreover, as infrastructures do ‘not grow *de novo*’ (Star 1999: 382), different types of infrastructure of value need to be adjusted to each other to work, otherwise compatibility issues arise. With the financialisation of land in Australia, tried and tested methodologies of farmland valuation started to fail with the international investors’ purchases filling local valuers’ databases with anomalous inputs. Moreover, new data sets (such as farmers’ bookkeeping, meteorological records) suitable to new valuation methodologies were not yet ready to hand (author2). In the case of Moldova’s Purcari winery, adjustments were also necessary to translate terroir to post-socialism. In certain respects, there appeared to be little friction. After all, evidencing infrastructures such as soil mapping had already been used during socialism to delineate pedo-climatic ‘microzones’. However, compared with French vineyards, these ‘microzones’ of regional specialisation were huge. To ensure compatibility



with the global market for fine wine and its promised profits, an adjustment of scale – here a downscaling, rather than an upscaling as in author2’s Australian case – was enacted.

In yet other cases, adjustment succeeds not due to the malleability but despite of the durability of material components of infrastructures, but only if ideational elements can be realigned (see Kappeler 2017). Mountainous landscapes did not allow mechanised coffee production in certain regions. This has been translated into profitable claims about concern for a ‘family farm’ model and ‘selective manual picking and sorting’ of specialty coffee. Yet, the Datterra farm in Brazil produced award-winning specialty coffee despite using science, technology and advanced machinery characteristic of its imaginary opposite: commodity-grade coffee production. By weaving the generic machines into the specialty coffee story about unique care for plants and soil, and by simultaneously shielding the ongoing mass market production from the visitors’ view, the seemingly generic elements of the production infrastructure could be successfully included in the qualitisng network (author5; see also author4 on how stories about peasant and industrial agriculture need to be aligned with material elements of infrastructures of containment).

All these adjustments between different components and types of infrastructures of value open up plenty of opportunities for advancing David Graeber’s project for an anthropological theory of value by examining the linkages between creative actions and larger, social totalities.

### **Conclusion: Towards a new historical materialism**

To study value through the lens of infrastructure allows us to uncover actions that are not visible if one focuses exclusively on the ‘noisy sphere [of circulation, the market], where everything takes place on the surface and in view of all men’ (Marx 2015 [1867]: 123).

Karl Marx laid bare the liberal illusions of market equality by entering ‘the hidden abode of production’, where the value of the commodity labour power is consumed by, and adding surplus value for, the capitalist. We have proposed infrastructures of value to guide our attention also beyond the usual suspects (capitalist and worker; wholesaler and retailer; marketer and consumer) to other beings (roads, cold stores and refrigerated cars, bottles and labels, vineyards and yeasts, social science concepts and economic models). We thereby strive toward a new historical materialism.

Infrastructures of value connect processes of production, exchange and consumption. For example, information infrastructures seriously shake the distinction between value production and value realisation and the idea that one precedes the other, because they not only communicate product features to consumers, but also change what is produced and what consumers want (Frohlich 2017; Besky 2020; author6, this issue). This powerfully challenges the partitioned view that sees use-values and exchange-value being first produced in the sphere of production, then exchange-value realised in the sphere of exchange, and finally use-values realised in the sphere of consumption. While infrastructures allow other things to circulate, how infrastructure shapes value can run counter to the visible movement of things, people and ideas.

So far, studies of financialisation have examined the crucial role of infrastructure in either valuation (performativity of market devices) or valorisation (fixing capital crises). Our special issue demonstrates how value is also shaped by infrastructures through the material creation (or creative destruction) of uniqueness and genericness that undergirds the dynamics of monopoly and competition, niche and mass markets, scarcity and abundance.

Transportation infrastructures enable and constrain the movement of things and people, making them either scarce or abundant in certain times and places. Thereby, they

shape just how large the relevant social totality is. Infrastructures of containment enable not only preservation, transportation and availability, but also the valuation of content by creating or destroying separations between inside and outside through processes of insertion and extraction. Both transportation and containment infrastructures may fulfil their value-shaping function largely invisibly as long as they work properly.

But visibility is key to information infrastructures, such as labels. These not only enable or constrain the circulation of claims about unique or generic product features, but also shape what is produced and how, by aligning the values of various actors. Legal and scientific infrastructures produce evidence of uniqueness or standardise generic forms and models. Deviations from standards may prove both valuable or valueless. As ‘adulteration’, uniqueness decreases value; as ‘innovation’ it increases it. In the interplay of infrastructures of containment, information, and law and science, what counts (as same or different) shapes the totality with which creative actions (or their products) are compared.

Finally, people enable or hinder the work of these different types of infrastructures through practices of ‘infrastructuring’. In particular, we drew attention to the sciences involved in designing infrastructures of value. A far cry from neutral observation, models produced not only by economics and natural science, but also by social science are performative in shaping value as they inform both abstracting projects of capitalism and concreting projects of resistance and alternatives.

Studying how infrastructures of value produce uniqueness and genericness helps to question enduring binaries and repeatedly claimed ruptures in economic anthropology by turning our focus to the material ‘frictions’ (Tsing 2004) generated by the historical and spatial layering of multiple infrastructures: between socialism and capitalism (author7, and author3, both this issue); between alternative and conventional food-value chains (author6,

this issue), between commodity grade and specialty coffee (author5, this issue); and between bulk and fine wine (author4, this issue).

Historical materialism has long ‘explored the material processes whereby nature and society were divided’. It was not so much interested in how to reunite these two poles, ‘but how and for what reasons they could have been separated in the first place’ (Choat 2018: 1039; see also Mitchell 2002: 30).<sup>13</sup> It has critiqued the colonial and capitalist compulsion to create value by transforming commons into private property and exploit human (and other) ‘nature’; the dialectic of surplus value generation through private ownership of the means of production within generalised market exchange; and the generation of extra surplus value by monopolies through technological innovations and access to transportation infrastructure. New materialism can deepen these insights into the materiality of value production, studying how markets and monopolies are made (and destroyed) by making beings through qualification processes either generic enough to be comparable and compatible or unique enough to be rare. Where historical materialism highlights the shortcomings of economic theories, new materialism spotlights the productivity of the sciences and the agency of non-human beings.

On the one hand, a historical new materialism that directs attention to power and inequality emerges when new materialists acknowledge that the infrastructures of containment, information, and law and science that enable valuation also require resources. In capitalist society, such infrastructures often become fixed capital and their infrastructuring turns into struggles about the value of variable capital. On the other hand, a historical materialism that views infrastructures through the lens of valorisation becomes ‘new’ when it acknowledges that the specific materiality of infrastructure matters because it affects the circulation of capital. The generation and destruction of uniqueness and

genericness through infrastructures shapes the value of labour power by configuring tastes, products, the kind of labour needed, and the availability of the produce.

With David Graeber (2001) we thus emphasise that value as the importance of actions transcends different social formations; and with [author8] (2019; this issue) we contend that value is produced by the mediation between apparently incommensurable value worlds. We add the powerful lens of infrastructures to uncover how creative actions link to larger social totalities and how values translate into market value through material configurations of uniqueness and genericness.

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### **Notes**

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1. According to Larkin (2013: 329, our emphasis), '[i]nfrastructures are matter that enable the *movement* of other matter.' We use Marx's term *circulation*, because infrastructures not only move or fix beings, but also allow and limit their transformation (or qualification).
  2. Since the 1980s, the studies of conventional agriculture and 'food regimes' tended to adopt a Neo-Marxist approach towards the 'global' structures of the production of exchange value, and the relations between the state and the market. Meanwhile, since the 1990s, studies of 'local food systems' and 'alternative food networks' have predominantly focused on the 'local' agency, values and consumption practices of civil society and community.
  3. David Graeber (2011: 21–41) exposed this story as the myth of barter.

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4. Some studies of finance have also highlighted the plurality of values, for example among investors (de Bondt 2005) or in Islamic banking (Maurer 2005).
  5. To avoid the loss of over-accumulated financial value, capital is invested in infrastructure with the hope of creating rent in the future (author2, this issue; see Appel and Kumar 2015; Muehlebach 2017; Buier, n.d.), sometimes with investor profits being guaranteed by governments (Bear 2017: 2).
  6. Digital information infrastructures like the Cloud are as material as roads, railways, and waterways (Vonderau 2019).
  7. Expanded definitions of the term infrastructure are not only debated in recent academic forums (<https://www.societyandspace.org/forums/ecologizing-infrastructure-infrastructural-ecologies>, accessed 20 April 2021). As infrastructure is often understood as a public good and therefore the responsibility of the state, political actors try to reframe various objects such as care or ecology as infrastructure, too. In 2013, a European Commission communication contrasted the multiple benefits of ‘green infrastructure’ to ‘single-purpose, grey infrastructure’ and thereby justified the substantial EU’s agricultural subsidies. The Chinese central government also published documents on ‘agricultural infrastructure’ which declare that the state should support the ‘protection of cultivated land’ and ‘soil improvement’. This broadening of the term has not become popularised, yet. In Daxi Village, rural citizens demanded state support for road construction, as they understood roads as infrastructure. But they did not (yet) demand higher agricultural subsidies, because they did not frame their transition to ecological farming as ‘green infrastructure’ maintenance.
  8. We expect that most readers readily recognise roads as instances of infrastructure as ethnographic object, while some might view our other types ‘only’ as applications of an epistemological vantage point on another ethnographic object. We think that the difference is only one of degree, as ethnographic objects are tailored by concepts and epistemological objects are informed by empirical insights (Hirschauer 2008).
  9. Probably energy infrastructures simply happened to work efficiently in our ethnographic cases and thus escaped our attention – as working infrastructures so often do. Growing attention to climate change makes future studies of value through energy infrastructure particularly promising.
  10. The quality of soil can have serious effects on agricultural land’s value. Rather than developing a perspective on soil itself as a form of bioinfrastructure (Puig de la Bellacasa 2013), author3 and author2 (both this issue) study the legal-scientific infrastructures that evidence certain

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qualities of soil. Others trace agronomic soil amelioration including large-scale mineral dispersal and the installation of drip-systems (author5).

11. We found Hans Ehrbar's translation (Marx 2010b: 4) superior to the standard version (Marx 2015 [1867]: 25).
12. For Andrea Behrends and her colleagues (2014: 1–2) a model is 'an analytical representation of particular aspects of reality created as an apparatus or protocol for interventions in order to shape this reality for certain purposes.' They stress that such blueprints cannot travel to new sites without translation, but need to be 'conveyed, carried, picked up, called for and interpreted by various actors.'
13. Unlike Latour (2005), who blames 'Marxist materialism' for reducing the 'bundle of ties' of the collective of human and non-human actors to 'a "material infrastructure" that would "determine" social relations', Mitchell counters that in 'social theory there is an important exception to the rule that human action is put at the center and the external world is treated as an arena for such action rather than the source of forms of agency and power. It is found in the work of Marx' (Mitchell 2002: 30).

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