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On the Block Train: Rethinking Block Technologies on the YuXinOu Express

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A special kind of freight train connects China to Europe: the YuXinOu express. Contrasting blockchain technologies with the YuXinOu block train, this article examines how the concept and technolegal operation of the block intersects with the geopolitics of China's Belt and Road Initiative.

Keywords: logistics, blockchain, block train, Belt and Road Initiative, China, Europe

Communication studies have long pursued the ambition of reading transport in concert with technology. The foundational texts of Harold Innis (1951) argue that the transport–communication relation cannot be thought in separation from questions of political economy, infrastructure, and geopolitics.[2] Yet, recent technologies of data transaction and management evoke fantasies of accountability and transparency that imagine an escape from the constraints of empire and economy that Innis emphasized. The arrival of *blockchain* in 2008 sparked hopes for a reliable distributed public ledger that could verify transactions and secure trust between actors independent of state power and centralized economic surveillance. Aside from the libertarian appeal of this vision, blockchain's neopositivist promise offered a technology of unalterable truth, released from the clutches of subjectivity, contextualization, and critique. Our claim in this article is

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[2] The relation between communication media and transport technologies is foundational to the discipline of communication studies. See Carey (1988), Innis (1951), Kittler (1999), Mattelart (1996), Morley (2017), Packer and Robertson (2006), Schivelbusch (1986), and Sterne (2006).

that such a fantasy of infallibility and openness is also a feature of block technologies that find applications in realms very different from that of cryptocurrency. We critically interrogate the notion of the *block*, which we understand as a technology of legitimacy that seeks to establish noninterference as a condition of security and efficiency in transmission and circulation. The article explores how the concept of the block emerged in the infrastructural context of railway signaling. Furthermore, we trace the making of the technology of the *block train*, which is a train that travels as an unalterable unit across diverse territorial expanses and infrastructural systems. Focusing on the YuXinOu express, a freight service that runs between the Chinese city of Chongqing and the German city of Duisburg, we ask how block technologies encounter chokepoints and borders that provide barriers and parameters for the negotiation of their efficiency. We thus open an analysis of China's Belt and Road Initiative to the transport–communication nexus, critically probing the relation of data and technology to geopolitics.

By focusing on block technologies that allow rail freight transport between China and Europe, we provide an account of what a block might be or do. Without claiming congruence or direct genealogical affiliation between the *block* in block train and the *block* in blockchain, we seek to show how one implies the other in ways that multiply the operational logic and space-binding work of the block. The journey of the YuXinOu express is not unusual inasmuch as railway stock has shunted through yards and along steel tracks since the 19th century. However, the traffic in commodities along this route is distinct for a fusion of transport and communication technologies that zone territory at a transcontinental scale unhindered by regimes of inspection. At least that is a core imaginary of the block train, and one that we investigate critically to cleave an analytical device that enables a geopolitical perspective on digital infrastructures more generally. Specifically, we question the operational logic of the block as an inscriptive technology whose transactions are endowed with transparency and accountability. Examining the logistical operations of the block train, we foreground how technical asynchrony and infrastructural dissonance as conditions of possibility splinter political and economic imaginaries of technofutures envisaged as imperial harmonization.

Introducing the YuXinOu Express

The metropolis of Chongqing is one of China's hi-tech production centers. Since 2009, Asus, Toshiba, Hewlett-Packard (HP), Acer, Foxconn, and many other tech firms have established factories in the city. In 2014, Chongqing exported approximately 20 million laptops to foreign countries, making it Asia's biggest laptop producing city (Seo, Chen, & Roh, 2017). Although the U.S.–China tech "decoupling" has led some companies to move parts of their supply chain away from Chongqing, the city remains a crucial manufacturing base. Laptops and other items of computing hardware are essential to today's digital capitalism, but these high-value commodities are prone to technological obsolescence. Shipping them from Chongqing to markets in Europe via the maritime route takes more than a month. Manufacturers understand the slow pace of maritime transport between China and Europe as a hindrance that decreases the value of products in an industry in which upgrades and updates are progressively faster and time as much as space compounds as an inventory liability. About 10 years ago, HP began to research possibilities for transport along the rail routes that have become known as the Eurasian Land Bridge. These railway links were previously rarely used for freight transport because of bottlenecks and inefficiencies at borders, customs, and at points of infrastructural rift, for example, the points of gauge change at the outer borders of the former USSR. In 2010, HP's Vice President Tony Prophet together with the economic technocrat head of

Chongqing local government, Huang Qifan, began talks with the Ministry of Railways and the General Administration of Customs in Beijing; later that year, the People's Republic of China agreed on easier customs-clearance procedures with Russia and Kazakhstan. Meanwhile, HP negotiated with German rail company DB Schenker to promote this transcontinental logistical undertaking (Y. Li & Taube, 2019). These efforts to develop a fast freight railway connection between Chongqing and Western Europe became one of the projects pursued under China's Belt and Road Initiative (BRI), officially announced by Xi Jinping in September 2013.

Operative since 2011, the YuXinOu express is a joint venture between the Transport Holding of Chongqing, the China Railway Company for International Multimodal Transport, RZD Logistics, Schenker China Ltd., and the Kaztransservice Joint Stock Company (RZD, 2012). The service is the oldest and most publicized of the many freight train connections now operating between China and Europe, having reached an average five trips per week in 2017 (Esteban & Li, 2017) and experiencing a boom in the midst of the coronavirus pandemic, which has led to blockages along maritime and air freight transport routes (Kastner, 2020). In 2018, the deputy director of China's National Development and Reform Commission reported that more than 11,000 freight trains had traveled between China and Europe since 2011, connecting 52 cities in China to 44 cities in Europe. Tjia (2020) notes that many of the new freight services have run infrequently or even for only a single trip. She suggests that local governments in China have orchestrated most of these initiatives with a view to ribbon cutting, attracting media attention, and fulfilling political targets of alignment with BRI. These tendencies have heightened since 2016 when the National Development and Reform Commission made subsidies available and centralized China–Europe freight projects under the name China Railway express. Although these services also attract local government subsidies, Tjia argues that there are now two types of freight trains running between China and Europe: those that meet politicized ends of "connectivity diplomacy" and those driven by economic and logistical rationalities. In consonance with recent arguments about logistics and infrastructure (Cowen, 2014; Easterling, 2014; Larkin, 2013; Neilson, 2012; Rossiter, 2016), we question such a division between politics and economics in order to track the ways in which logistical initiatives generate their own forms of power and territory. Central to this generativity for us is the technology of the block, which provides the primary operational means by which transcontinental freight train services such as the YuXinOu express establish claims for productivity and efficiency.

Block Trains and Chokepoints

Traveling westward, the YuXinOu express carries predominantly laptops and other electronic goods such as mobile phones. Eastward, it transports items such as industrial plant equipment, fashion goods, spare parts for BMW and Mercedes motor vehicles, and luxury food and alcohol products. The trade disparity between Europe and China means that many empty containers also make the return journey, following a pattern of import–export economies seen elsewhere in the world. However, Kastner (2020) reports that the coronavirus pandemic has at least temporarily paused this practice of returning empty containers to China via overland freight rail. The route traversed by the YuXinOu express passes through China, Kazakhstan, Russia, Belarus, Poland, and Germany. Although there is also an increasing frequency of scheduled services that carry goods supplied by multiple producers along this route, block trains are the main technology employed to achieve the rapid transit of high-value and time-sensitive commodities. A block train consists of a designated set of freight wagons that are dispatched at the same time, from one and the same consignor, to one and the same consignee, via one and the same transport route, to one and the same station of destination. This fixed informational and infrastructural ensemble runs along the same tracks as other freight trains but is regulated differently. YuXinOu block trains use a fixed array of signals, a steady arrangement of carriages with prescribed length, and protocols negotiated between railway administrations in the six countries along the way to ease their passage across the borders of nation-states and supranational customs unions. A constellation of communication technologies, legal regimes, and material conditions enables the movement of block trains to make this kind of freight transport a regime of transmission and reconstitution of existing infrastructures that bind the BRI within a Eurasian orbit. Even though block trains are not a BRI invention, their importance for the initiative, which has made them a flagship project of China–Europe trade, is clear. In the context of BRI, block trains make possible logistical connections that integrate the transportation of commodities and the transmission of information to produce the political and economic territories imagined under the umbrella of the Chinese new Silk Road.

BRI block trains have become one of the primary instruments used in China–EU trade to speed up freight transport across multiple national and infrastructural borders. To achieve this, interference and complexity are minimized along the railway network. Once a block train service is established, a company like HP can transport laptops in a way calibrated to the value and time-sensitivity of the commodities at hand—faster than cheaper container shipping and less expensive than prompter air freight (Seo et al., 2017). The journey starts by preparing load documentation, booking the train (if it is not a prebooked service), and issuing barcodes for the containers that will be checked and sealed once the laptops are loaded (S. Li et al., 2019, p. 10). YuXinOu block trains leave China on a schedule agreed between the railway operators of the countries along the way. The journey lasts 14 days, a significant improvement on the 25-day train shipment period achieved in 2011, when customs agreements and logistical collaboration were first negotiated. In Chongqing, the block train accommodates carriages up to a maximum length of 750 m, a limit determined by the technical properties of the railway infrastructures along the route. As Polish railway networks allow for a maximum length of 750 m and the cargo of the block train must remain unchanged, this load restriction is consistent for the entire journey (NEAR2, 2013, p. 40). The wagons are checked and cleared at customs, sealed with e-locks, and issued a combined CIM (Convention Internationale Concernant le Transport des Marchandises par Chemin de Fer)/SMGS (Соглашение о международном железнодорожном грузовом сообщении) consignment note that serves as a customs clearance waiver for the entire trip (S. Li et al., 2019). CIM and SMGS are international agreements for rail freight transport that determine two international zones of documentation for customs inspection. CIM has been adopted by the majority of countries in Europe and the Middle East, and SMGS is signed by countries in the former USSR, Central Asia, China, Vietnam, and North Korea.

From Chongqing, the train travels for two and a half days to the border of the autonomous region of Xinjiang and Kazakhstan, where a diesel engine hauls it to Altynkol station on the Kazakhstan side. At Altynkol, the train is x-rayed to check consistency between cargo load and documentation, a process that takes approximately 3.5 hours for block trains, sped up from the usual 4.5 hours for multiblock trains (United Nations Economic and Social Commission for Asia and the Pacific, 2016, p. 7). The train then moves to the new dry port at Khorgos where gantry cranes lift containers from the narrow 1,452-mm gauge wagons onto broad 1,520-mm gauge wagons that are used on the tracks on the territory of the former Soviet Union. From Khorgos, the train travels through Kazakhstan and the Russian Federation to the border with Belarus, where it continues with no customs checks until it reaches the Belarus–Poland crossing point in Malaszewicze, Poland. There, the containers are again lifted with gantry cranes and put on narrow 1,452-mm wagons so they can proceed along the European railway network (Goh & Goettig, 2018) to Duisburg. Malaszewicze is a renowned chokepoint on the route. A European Commission report (Pieriegud, 2019) explains delays at this crossing as stemming from minimal track infrastructure at terminals, lack of modern control devices on the ring line, and limited availability of wide-gauge track and bridge capacity. If the Khorgos dry port has emerged as one of BRI's keystone projects, inspiring glossy write-ups in *The New York Times Magazine* (Mauk, 2019) and sophisticated collaborative design platform initiatives from Moscow's Strelka Institute (Clavijo, Sivers, Anisimov, Zhileikin, & Gromova, 2019), the Malaszewicze bottleneck is its dirty secret. Although technical and infrastructural upgrades are in progress at this border crossing, reports indicate an average waiting time of 10 hours for gauge change (van Leijen, 2018). The flow-on effects of this holdup reproduce up and down the line. The manager of the Khorgos dry port, for instance, attributes a fall in productivity to "congestion on the border between Poland and Belarus" (Suzuki, 2019, para. 14). No matter how seamless the processes that facilitate block train movement, its operations cannot be insulated from contingencies on the ground, particularly at chokepoints, which are notoriously sites where the analog outperforms the digital (Carse, Cons, & Middleton, 2018).

How Block Trains Mold Territory

Apart from being secured with e-locks, YuXinOu carriages are fitted with GPS tracking devices. The limits of such digital sealing and tracking in protecting the block from interference is a phenomenon we explore later in this article by investigating resonances in the operations of block trains and blockchains. For now, we note that block train efficiencies affect and are affected by the environments through which the train moves. Anthropological and geographical studies emphasize that railways never escape the conditions of their making and maintenance. Whether in the shared paths of Indigenous and Asian American histories forged by the building of North American railroads (Cowen, 2019; Karuka, 2019) or the speculative arrangements surrounding the construction and repair of India's rail network (Bear, 2020), the interweaving of colonial power and economic path dependency leaves its mark on present infrastructural installations. In the case of YuXinOu gauge changes, the freight train's operators grapple with the historical reality of the Soviet Union. Wide-gauge tracks were introduced to Russia in the 19th century (Haywood, 1969). Contrary to the widely held conviction that the USSR retained its wider gauge as a national security measure to hinder invasion, the gauge remained mostly because of the high cost of completely dismantling the whole railway infrastructure network (Puffert, 2002). Still, during the Soviet rule over Poland and Ukraine, some of the major railway tracks connecting them to the territory of Russia were changed to the Russian wide-gauge tracks. Liberal orthodoxy understands the collapse of the USSR as a result of unsustainable economic planning, but Soviet infrastructural accomplishments continue to influence the rollout of projects such as the YuXinOu express. Like the building of the Druzhba pipeline, which was partly designed by cybernetician Viktor Glushkov and still carries oil to Western Europe (Radynski, 2017), the laying of wide-gauge rail tracks across the Soviet Union registers the role of infrastructural interventions in molding political and economic territories. Now independent states, the countries from the former Soviet Union are still bound in a common infrastructural space through the use of the wide-gauge tracks that separate them from the rest of Europe and Asia.

The YuXinOu express not only acquires political meanings that layer onto past logistical geographies, but also shifts present relations of territory, economy, and power. Grant (2020) details how the delivery of infrastructure through China–Kazakhstan collaboration occurs "against a backdrop of anxiety and exclusion in the Sino-Kazakh borderlands" (p. 7). Whereas the hype surrounding installations at Khorgos and beyond attracts Kazakhs across the border in search of economic opportunity, the suppression of Muslims in Xinjiang has led to the detention and harassment of many cross-border migrants. As Bitabarova (2018) explains, the fact that Kazakhs as well as Uyghurs are subject to processes of securitization and racialization in Xinjiang means that increased economic and logistical cooperation has not led to an improvement in negative Kazakh perceptions of China. Xinjiang, for which the *Xin* in YuXinOu stands, has a long history of Chinese military control and Muslim minority resistance, ramped up in recent years with digital surveillance technologies. Train stations have been targets of Uyghur resistance and the upgrading of transport networks and logistical services lies at the heart of Beijing's development narratives. The introduction of BRI in 2013 also corresponds with support and direction from Beijing of one of the main governmental organizations involved in Chinese military and economic domination over Uyghurs in Xinjiang, the Xinjiang Production and Construction Corps (Bao, 2018).

BRI interventions affect physical environments as well as human populations. The railroad is not just a means of transport, but also a technology of organizing and categorizing landscapes and territories. As Sternberg, Ahearn, and McConnell (2017) argue, "Infrastructure does not exist in a vacuum; it's a very land-based, physical undertaking that conforms to or manipulates an environment" (p. 55). The presence of large mountain ranges between China and Kazakhstan, for instance, shapes cross-border logistics. Take the construction of the logistical hub and special economic zone at Khorgos: These developments displace cross-border traffic at the Dzungarian Gate to the north, a natural valley path that historically provided the only passage through the mountain wall. BRI interventions at Khorgos also make demands on land and water. The picture becomes more complex given links between water and security in Central Asian countries, the transboundary nature of water, and the fact that land and water systems based on Soviet structures do not lend themselves to international collaboration (Sternberg et al., 2017). Both reactive and oriented toward controlling the future (Karuka, 2019), infrastructural projects that support block train movement reconfigure relations of land, geography, and territory, changing and adapting to physical environments in pursuit of perceived economic and developmental benefits.

These social, physical, and territorial effects impact unevenly along the block train route, but become particularly visible in sites where delays mean that interventions external to the operationality of logistical coordination supplement supply chain economies. In Malaszewicze, as in Khorgos, such ancillary initiatives include the building of dry ports, warehouses, shopping malls, and even whole city districts in an attempt to turn logistical impediments into strategic commercial advantages (Stevens, 2018). Another site of BRI transformation is the ailing German industrial town of Duisburg, the putative terminus of the YuXinOu express, which has rebranded itself as Germany's China city. Apart from the expansion of Chinese business in the city, Duisburg has seen the enlargement of the intermodal terminal that handles freight rail traffic from China and approval of plans by the Chinese developer Starhai to build a China Trade Center Europe. In addition, Duisport, the operator of the city's inland port, supposedly the largest in the world, has become active in making investments along BRI routes.

Duisport’s BRI investments are not restricted to infrastructure and logistical facilities along the YuXinOu route. Rather, they diversify the company’s interests across the three different BRI rail freight lines that connect Duisburg to China. Apart from the YuXinOu route, these include the northern route, which follows the path of the Trans-Siberian railroad from northeastern China and then uses the same course as YuXinOu from Perm in Russia, and the southern Route, which passes through Kazakhstan and enters Europe through Turkey. In 2016, Duisport formed a joint venture with Turkish construction company Arkus Holding SA and invested in the building of a logistical hub on the eastern side of Istanbul, securing influence over the southern rail freight route (Duisport Group, 2017). Similarly, in 2018, Duisport acquired a minority stake in Great Stone, a logistics hub located 25 km from the Belarusian capital of Minsk, on both the northern and YuXinOu routes. Working in partnership with China Merchants Logistics, Belarus state railways, and Swiss firm Hupac, the company plans to build a new rail terminal at this site to relieve the congestion at Malaszewicze (Duisport Group, 2018). Investment patterns of this kind evince an emerging model of logistical governance that controls commodity flows between countries through the use of social-technical and financial tools for restructuring political and economic territories. These tools are entangled in mechanisms used for the development and management of facilities such as ports, railways, and logistical terminals, which treat strategic hubs and border areas as moldable territories that can be reconfigured geopolitically and geoeconomically through the investment and building of logistical infrastructures.

The YuXinOu express also reconfigures territory in juridical ways. Consider the CIM/SMGS consignment note that allows the block train to pass between territories that are party to the CIM agreement and those that adhere to SMGS. These agreements work with different legal definitions and frameworks, which are determined by the history of emergence of the two international organizations. CIM was the common legal framework for international railway traffic in Europe until the end of World War I, when the newly established USSR found itself removed from the list of signatories (Zhu & Filimonov, 2018). After being unable to negotiate its return to the convention, the USSR formed a separate convention among countries from the Socialist Bloc in 1950, with China joining in 1954. Although CIM allows for greater legal flexibility in negotiating contracts, SMGS assumed until 2015 that government departments were the exclusive agents of legal and trade negotiations (SMGS Convention, 2015). The CIM/SMGS consignment note is a hybrid document that combines the consignment notes issued under each of the conventions, aligning their standard fields in parallel to each other and including both contractual forms in the document. In itself, this compact of procedures does not harmonize the two legal regimes but, rather, allows for the transition from one regime to the other in the course of the journey without having to transcribe the documentation in a new form.

With the publication in 2019 of protocols for the digitalization of this legal device (International Rail Transport Committee, 2019), the CIM/SMGS consignment note effectively became a platform for data sharing and exchange. The forwarding of data in advance of train movements means that contractual obligations acquire legal effect when they arrive in the recipient’s information-processing system. This arrangement creates a series of spatial and temporal displacements generated by differences in travel times for data and trains. That the goods carried by the YuXinOu express cross international borders and customs barriers legally before they do so physically sets up a disjuncture between jurisdiction and territory, which is further exacerbated by the time taken for transfer between infrastructural systems. Territory is remade through technolegal procedures of information exchange, on the one hand, and the operations of infrastructural systems for the physical passage of goods, on the other. All of these systems are leaky, with mistrust, security concerns, and even linguistic and cultural differences standing in the way of a fully automated proceduralism that would allow the block train to move independently of its environments, physical, digital, and legal. This is a key point when it comes to critically interrogating the notion of the block. Understanding and tracking the workings of the block in concert with seemingly external conditions and protocols are essential to opening and questioning the operational logics that position this technological device as an icon of transparency and accountability.

Genealogy of the Block in Railway Signaling

The notion of the block is central to the operation of railway networks. In railway traffic systems, the block functions in two ways: As part of the signaling infrastructure, it defines the relationship between moving trains and the sectioning of rail track infrastructure; and as part of the train composition system, it organizes the relationship among freight cars, trains, and points of origin and destination on the tracks. In both of its functions, however, the block is key in organizing mobilities within the railway network system through a combination of discretion and categorization that divides tracks into blocks that can be occupied by only one train at a time and combines cars into blocks that have the same origin and destination. This makes single-block trains the most efficient rail freight transport, which is also the most common composition of freight trains bound for Europe from China (Lin, 2017, p. 3).

The YuXinOu block train constitutes a specific technological form and bureaucratic standard designed to ensure efficiency of movement across borders and through checkpoints. A freight train is classified as a block train when supporting documentation verifies unaltered details of the consignment and carriage composition between end points. The relation between length of train and block conformity is determined less by the political economy of standards than by the physics of speed and transmission of light. Transport and communication technologies coalesce in the form of the block. Once relayed through the optics of vision and kinesthetics of adjusting pressure of the foot on the brake pedal, signaling and braking systems are now computationally enacted. The genealogy of signals and modulation of speed nonetheless remain an index of the constitutive force of physics independent of geopolitical governance and ratification of universal standards.

Due to the physics of weight and speed, a train is so heavy that its braking distance is longer than the distance measured by the driver's eyesight. By the time the driver sees an obstacle, it is already too late to stop. The block is an important development in locative technology for the organization of railway traffic. It divides the railway network into a series of blocks, each of which can be occupied by only one train at a time. The origin of the block comes from the telegraphic system of signaling of train traffic at stations in the 19th century. In his history of railway block signaling, Pigg (1897) describes the evolution of signaling systems from the initial use of bells at stations and transmission of telegraph messages between them to the later evolution of so-called line occupation signaling. The three signals introduced with line occupation signaling were "line clear," "train on line," and "line blocked." This latter signal was used to halt traffic along a line in the event of an emergency. The notion of a block expanded to include distinct intervals of railway tracks between stations, with manned signaling stations positioned at intervals along the line and signalmen responsible for issuing telegraphic messages to neighboring stations to inform them of the movement of trains passing by. Usually uninhabited today on many expanses of track around the world, these signal stations remain lonely edifices of a communication–transport nexus special to an analog epoch surrendered to the authority of the digital.

Nowadays, GPS systems and sensors support the automation of train location tracking, complicating the concept of the block. So-called fixed block signaling systems operate through track circuits that detect the presence or absence of a train at any point on the railway. In addition, balises, or transponders located between tracks, transmit information to trains about the railroad, such as speed restrictions and curves in the track. In the fixed block signaling system, blocks are defined distances along the railway and the location and movement of trains are determined and regulated in relation to these blocks. In the moving block signaling system, which is an emergent standard in international railway traffic, trains use radio signaling to coordinate their movement in relation to other trains through communication to a radio block center rather than in relation to fixed points on the railway tracks (European Railway Traffic Management System, 2017; Harriss, 2016). This new digital technology of signaling and identification is the latest standard for railway signaling, Level 3 from the European Rail Traffic Management System and Level 4 from the Chinese Train Control System (Ning, Tang, Qiu, Gao, & Wang, 2010). Trains must be equipped with a train integrity monitoring system and a radio signaling system to use moving block technologies.

The concept of the block train derives partially from these systems of signaling and railway traffic regulation. Yaghini, Foroughi, and Nadjari (2011) point out that "mathematically, the railroad blocking problem is a multicommodity-flow, network-design, and routing problem" (p. 5579). Railway block management regulates the way commodities move between destinations, as well as how the railway network is organized as a system that allows the movement of multiple freight flows (Xiao & Lin, 2016; Yaghini, Seyedabadi, & Khoshraftar, 2012). To build efficiency into systems of train composition and cargo delivery, freight trains are divided into distinct groups of carriages that are bound for the same block in the rail network. These carriage groups are also referred to as a block, so, in this sense, a block is a unit of train cars that all have the same origin and destination pair (OD pair; Xiao & Lin, 2016). The block means that a section of the train, the block, will not be recategorized and recomposed at every classification yard along the route, but will instead move between its points of origin and destination without interference. The OD pair, in turn, is defined through the signaling block sequencing of the railway tracks, which through a series of switches and crossings guide trains from one track to another until "each group of railcars . . . reach[es] their assigned blocks" (Zhang, Song, He, Li, & Guo, 2018, p. 2). The formation of such blocks is an important technology for the coordination of railway traffic through the categorization and organization of trains.

This conception of what a block is and how it is defined in relation to the circulations it regulates also shows an important development in transport and communication infrastructures. The block marks the merging of communication, movement, and locative technologies in the evolution of signaling devices and networks of transmission (see Sprenger, 2019). As the train moves, it continuously signals its own location, registers its position, and identifies itself. The block train is a specific mode of logistical transmission determined by signal frequency and its physical occupation of space, again defined through signals. The YuXinOu express squeezes and packs together, assembles and streamlines, providing a format for the transfer of commodities along the BRI railway infrastructure.

In most instances of conventional rail transport, wagons are assigned as multiblocks destined for unloading at specific locations en route. These wagonload trains may be decomposed and reloaded numerous times throughout the journey. A block train has just one such stop because all wagons compose a single block for unloading at the termination of the journey. This fixed infrastructural and procedural characteristic of the block train is an attempt to minimize delays at border chokepoints. In the last few years, the number of block trains running between China and Europe has increased, with services linking different preassigned destinations in China and the European Union. Consignments travel under a specially negotiated Single Declaration and Inspection on Entire Journey (Xinyi, 2019) and under the condition that from loading at the origin to unloading at the destination the record of the commodity load remains unchanged. Any changes or potential ambiguities—recomposition of the train, combined shipping to different consignees, splits and merges of carriages along the route—mean that the customs documentation has to be verified and revised, resulting in prolonged delays at marshaling yards and border points. Tampering with the block risks potential refusal of onward passage.

Block Politics

Having traced the origins of the block concept in railway signaling and considered its deployment in BRI freight train projects, we are now in a position to reflect more generally on block technologies. Such an extension of our argument is not a simple matter of transposing our understanding of the block into new technical and economic contexts. Blocks enable transmission and circulation by virtue of their supposed immutability. As we have argued, this unalterability emerges partially from the dependencies of the block on its environments. Although block politics attempt to construct an abstracted infrastructural context, in which the block is defined in relation to other blocks, the realities of physics, ecosystems, territories, and populations through which blocks are produced and constricted, and with which they interact, create fissures in this infrastructural insularity. In the case of the block train, this interference is particularly evident at chokepoints. In the instance of a more recent block technology such as blockchain, the technical processes that seek to remove blocks from their physical, juridical, and social environments have become more refined and able to withstand the intrusion of externalities. But only up to a point. Key to blockchain operations is the production of distinct blocks through the solving of cryptographical problems. Each block contains the entire history of those that precede it, meaning that the accuracy and verifiability of the information it holds are vouchsafed by network effects that extend across the wider system rather than referring to a singularly stored and definitive ledger. However, this much-celebrated logic of decentralized communication, and therefore governance, needs to be measured against the centralizing effects of data storage facilities and the political economy surrounding these digital infrastructures and their data economies. A similar dynamic of transaction security coupled with geoeconomic contest is evident in the case of the block train.

The block train reveals the significance of the block as a technology that promises efficiency and security through infrastructural configurations. Determined by both its singularity and its place within a network sequence, the block is deployed as a principle that underpins transmission and circulation. In this function, the regulation of a block's positioning has importance for its ability to enable the transfer of commodities and value. The railway signaling block system is built on the premise that blocks are distinct but interconnected stretches of track that follow each other sequentially. The predictability of the block's length and location allows train movement to be registered in relation to these defined intervals. Likewise, blockchain technology is based on the condition that blocks cannot occupy the same position in the blockchain. The simplicity of this infrastructural solution is, however, undermined when we look at the issues related to how a block is produced. In the geopolitical and geoeconomic context of the YuXinOu express, for instance, the block cannot function only through infrastructural regulation. The infrastructural network itself is not a smooth space but, rather, one fractured by its different historical and political contexts of design, such as those that are the legacy of the Soviet railway system. Although the composition of train blocks is part of the routine arrangement of rail traffic operations, assembling the YuXinOu express entails agreements and adjustments that navigate the ruptures in physical infrastructure as well as different legal regimes of control over trade and mobility across borders.

This layer of control shows the limitations of a purely infrastructural governance of circulation, which is always interrupted by and interrupts social and political contexts. If this tendency was pronounced in block train operations, it has become even stronger as block technologies have evolved. Crandall (2019) notes that most critical literature on blockchain is "generalized, theoretical, and global" (p. 280). There is a lack of research that seeks to understand blockchain in "sited context." Crandall's research concerns the relation between blockchain and historical "chains of empire" in Puerto Rico, focusing on governmental efforts to incentivize cryptocurrency and other blockchain initiatives in the archipelago. It is easy to imagine a similar inquiry that addresses blockchain activities along the YuXinOu route. Xinjiang is the world's foremost Bitcoin mining region, giving it a concentration of blockchain activities at more than 35% of average monthly global hashrate (Cambridge Centre for Alternative Finance, 2020). It is equally possible to consider the uses of blockchain in Duisburg's smart city initiative (Mika & Goudz, 2020) or Belarus's 2017 establishment of an extraterritorial high-technology park in which blockchain business goes tax free (Belko, 2019). Doubtless, in each of these instances, social, political, and economic factors combine to shape blockchain activities in ways that cannot be fully explained by technological and infrastructural constraints. However, this is not the only way in which we seek to rethink block technologies. Rather, we ask how two very different kinds of block technology encounter points of constriction and negotiation that make their operations work against their tendencies to rapid transit, in the case of block train, and decentralization, in the case of blockchain.

The attention paid to chokepoints in our analysis of the YuXinOu express can be transferred to a consideration of blockchain. One of the problems that blockchain faces is the need to navigate among decentralization, efficiency, and legitimacy in the production of blocks (Buterin, 2014). The risks associated with decentralized competition in the mining of blocks lead increasingly to the formation of mining cartels, which Leonardos, Leonardos, and Piliouras (2020) suggest is evidence of the "existence of a negative feedback loop in terms of decentralization as a core ingredient in permissionless blockchain philosophy" (pp. 14–15). Parkin (2019) highlights other chokepoints that affect blockchain operations, including the centralization of decisions about software changes, the presence of bureaucratic business models, and the embeddedness of technical knowledge in industrial agglomerations. Our purpose in mentioning these patterns of technical constriction and knowledge centralization is not to highlight points of obligatory passage that are supposedly features of all networks (Callon, 1984), but to show how block technologies, despite their claims to reliability predicated on closure, open network operations to external interference. The operational closure underscored by receptiveness to externalities produces a recursiveness that, although seemingly typical of a contained cybernetic system, is in fact generative of liability and contingency. The critical question here concerns the distinction between the ostensible security of the block as technical architecture and infrastructural form and the fact that its existence as a singular entity with a number and position invites its removal from the sequence that vouchsafes its reputed unalterability.

When is a block no longer a block? In the blockchain world, blocks are decommissioned frequently. When two different miners solve the cryptography to generate a new block within moments of each other, the chain has to fork to avoid the situation in which the presence of two versions of the same block introduces uncertainty to the system. The block not selected by peers in the network, which is inevitably that with the shortest chain, becomes worthless and the transactions that brought it into being are queued in a memory pool. The whole process is glitch-like. This dissembling of moments in which blocks seemingly vanish is key to maintaining ideologies of control and the political economy of time as they pertain to transaction and transmission. Disruption eludes the intentional fallacy of technological design while, paradoxically, enabling a system to adjust and adapt to external forces. Such technical-infrastructural tendencies are suggestive of contemporary operations of capital insofar as they depend on interactions with their multiple outsides. Without space to elaborate these claims (although see Mezzadra & Neilson, 2019), we might ask what kind of politics follows from such logics in which the line between inside and outside is up for negotiation. The triumph of extraction economies is such that the game is no longer one of winner takes all. Rather, in conditions of extensive depletion, the hegemon is the one who declares abnegation of control, authority, and monopolization of wealth. This is the ruse of the block as a decentralized accounting system. But as we show, when the block is trafficked as an ensemble on rails, the path is determined from origin to destination. Something similar is true for blockchain, which, at least in the case of Bitcoin, produces blocks in an exponentially declining manner, beginning with the so-called genesis block and proceeding until a foreknown quantity is reached at a foreseeable future time (Maurer, Nelms, & Swartz, 2013). Just as the economy of inscription special to the block train is unable to account for cargo that goes off the rails, the blockchain ledger cannot tolerate replication or optionality.

Our analysis of block technologies reaches beyond commentary on the affinity of blockchain enthusiasm to libertarian and neoliberal ways of thought (see, e.g., Golumbia, 2016) or criticism of the neopositivist truth claims that emerge from blockchain's modes of cryptographic decentralization (Haiven, 2018). Rather, highlighting the resonances of parallel block technologies draws attention to the qualities of the block itself and its role in regulating the risks of circulation. In the case of the YuXinOu block train, the creation of certainty about freight contents means that time-sensitive commodities can travel faster. Making the train into a block streamlines its passage, which, as we have seen, is nonetheless vulnerable to delays generated from historical, political, and infrastructural factors external to the block technology. With the block train, compliance of load ensures calculations of speed and delivery of consignment. In the case of blockchain, the ledger seeks to provide a record of account, allowing cryptographic proof to serve as a mode of governance. In both cases, governance is liberated from the burden of difference as consistency of transaction is assumed by accounting technologies. The hegemony of standards is designed to subtract occasions of dispute arising from the fallibility of social and technical variation. Yet, the infrastructural illusion of security is also the center of gravity for contingency to wreak havoc on control.

In the influential argument of Foucault (2008), security is a condition of and reaction to liberal circulation. Block technologies extend this logic, seeking to eliminate contingencies through a production of epistemic certainty that cuts through situations of mistrust, competition, and historical discord. The production of a block strives to make certain actions impossible—for example, actions of replication, reordering, or diversion. The block is the logistical system par excellence, if, with Harney and Moten (2013), we understand the logistical system as that which seeks to "dispense with the subject altogether" (p. 87). Little matter, then, that the block train is associated with the expansionary ambitions of Beijing, and blockchain seems a technical instantiation of the Californian ideology. In its management of compliance, the block subtracts free choice from liberalism as much as it embodies the ways in which authoritarian personality grapples with routines of risk assessment and market hedging. Here, the block appears as a transcendent signifier that invites political imagination of territory and economy unhinged from modern logics of governance tied to forms of statecraft unsuited to the agility of the digital. But as we foreground in this article, nothing is as square as the block. Which is to say, the geometry of control so often attributed to the block predicates on its inability to go anywhere. Unlike the shipping container, the block is not a modular technology that one can pick up, fill, and shift around at will. The block seeks to liberate circulation from contingency only by pinning itself to a fixed path or nonnegotiable sequence. Hitching the nexus of communication and transport to block technologies is thus a perilous endeavor that disables visions of futures unknown or divorced from data-enhanced prediction. There is political purpose to showing that the block is vulnerable to idiomatics not translatable within grammars of efficiency, calculation, or verification. A kind of subaltern economy subsists as the distillation of revenge on the universe of the block.

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