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High-frequency trading and the technological constitution of anomie

Hochgeschwindigkeitshandel und die technologische Verfasstheit von Anomie

This article addresses the emergence of high-speed algorithmic trading in financial markets by analysing it from a specific criminological perspective of anomie. The drive for speed and automation in trading activities brings with it technical and organisational constitutions of epistemic uncertainty while also shaping new forms of trader subjectivity. Equally, regulation plays a key role in the nature and practice of financial innovations and technological change. In combination with changes in trader subjectivity, these developments constitute a dynamic drive for unlimited and post-human capital accumulation, rendering into existence technical and cultural practices which serve to systemically disavow capitalism's harmful dynamics.

Keywords: financial markets, high-frequency trading, algorithms, speed, anomie, epistemic uncertainty

Der Artikel befasst sich mit der Entwicklung des algorithmischen Hochgeschwindigkeitshandels an den Finanzmärkten und analysiert diesen aus einer speziellen kriminologischen Perspektive von Anomie. Das Streben nach Geschwindigkeit und Automatisierung von Handelsaktivitäten erzeugt technische und organisatorische Bedingungen epistemischer Unsicherheit, welche zugleich neue Formen der Händler_innensubjektivität prägen. Zudem spielt Regulierung eine zentrale Rolle in den Eigenschaften und der Praxis von Finanzinnovationen und technologischem Wandel. In Verbindung mit Veränderungen in der Händler_innensubjektivität sind diese Entwicklungen als Teil eines Verlangens nach unbegrenzter und posthumaner Kapitalakkumulation zu verstehen, die technische und kulturelle Praktiken ins Leben rufen, welche dazu dienen, die schädliche Dynamik des Kapitalismus systematisch zu verleugnen.

Schlüsselwörter: Finanzmärkte, Hochgeschwindigkeitshandel, Algorithmen, Geschwindigkeit, Anomie, epistemische Unsicherheit

Introduction

In light of recent developments in the financial system, which come with an increased drive to augment regulatory knowledge practices (Coombs 2016), this paper asks a rather different question to those put forth by the majority of sociotechnical scholars of finance. There is already a strong and growing body of literature and research within the wider social studies of finance (SSF) network, which addresses sociotechnical interactions, networks of human and nonhuman actors, and their spectral interaction within sociotechnical networks (see Callon 1998; MacKenzie 2006; Knorr Cetina/Preda 2007). Most recently, this has led to a collection of articles which deal with the phenomenon of high-frequency trading (HFT), and in particular the resultant regulatory implications with regards to the speed and knowability of markets (see Lange/Lenglet/Seyfert 2016; Castelle et al. 2016; Lenglet/Mol 2016; Lange 2016; Seyfert 2016; Coombs 2016). These provide useful insights into the cultural phenomenon of HFT, material speed advantages against financial regulation, "what works" approaches to regulatory practices, and the importance of technological and political change in the emergence of electronic/automated markets. Unfortunately, such contributions largely overlook on the one hand, political economy as a critical starting point in understanding financial industries and on the other hand, issues of subject relations in the context of increasing automation. While the latter is discussed, it is done primarily from a purely phenomenological perspective leaving aside questions of subject(-ive) morality.

In a rectifying turn, this article analyses the emergence of HFT not only as a sociotechnical phenomenon, but by placing it in a criminological perspective which aims to re-establish some roots in the political critique of an unethical society (Horsley 2013) while calling for the criminalisation of harmful practices and behaviours (Hall 2012). Building on initial criminological insights into sociotechnical practices and concerted strategies of not-knowing, similar dynamics are outlined in HFT in the interaction between technical and organisational divisions of labour. The resultant epistemic uncertainty in regulation, compliance, and trading strategies is then discussed in light of a drive for speed and ultra-low latency which promises to ensure profitability and objectivity through algorithmic technology. Further to this, the emergence of HF and algorithmic trading is explained in challenging the popular narrative of deregulation, arguing instead for a more dynamic understanding of financial regulation which shapes the nature and practice of HFT. In combination with technological enhancement and change, this dynamic tension between regulation and innovation is situated amidst a criminological agenda which aims to understand anomie as the systemic disavowal of capitalism's harmful dynamics.

The sociotechnical constitution of epistemic uncertainty

The criminological literature on emergent sociotechnical practices has focused primarily on "technologies of control" (see Lianos/Douglas 2000), at times calling for the discipline to become more relevant to crime control and prevention (see Clarke 2004), and emphasising elsewhere the inadequacies of legal and regulatory systems in challenging the increasing computerisation and speed of communications technologies (Gandy 1989). Where Lianos and Douglas (2000) appreciate the tendency for automated technological mediation to replace human relations of trust in the realm of “technologies of control”, in the context of the financial industry more broadly and HFT specifically, these might be thought more dialectically as “technologies of desire”, in so far that the material constitution of electronic trading activities is situated amidst a historical trajectory and desire towards automation and post-human capital accumulation. The dramatic increase in bureaucratic advantage through automated communication networks is here more than the simple outcome of technological development and instead points to regulatory circumstances which gave way for these automated processes to emerge.

While Coombs (2016) argues that it is more fruitful to concentrate on “degrees of usefulness” within the context of regulating against systemic risk, this paper picks up on Lange’s (2016) insight that ignorance can become a “strategic unknown” as an object of desire for high-frequency (HF) traders. In criminology, this is not an unfamiliar phenomenon, starting with Katz’ (1979) paper on “concerted ignorance”, where he links strategic unknowing/not-knowing to feelings of shame and the need to keep intact a “pristine image”. Elsewhere, Hallsworth and Young (2008) consider corporations’ use of silence clauses in contracts to deter potential whistle blowers from speaking out about questionable or illegal corporate activities, and take account of mental mechanisms to justify silence for reasons of risk or perceived powerlessness. Van de Bunt (2010: 435) explores this further in shifting the focus in ineffective regulation to the problem of “successful concealment of illegal activities by the perpetrators and the silence maintained within their social environment”. In other words, institutional cultures of secrecy and silence often lead to difficulties with detection and prosecution. Minkes (2010) on the other hand, re-orientates the attention from silence to invisibility, suggesting that ignorance of corporate misconduct results more commonly from perceived ambiguities of particular illegal acts and comparatively little regulatory oversight. Such ideas, inspired by the original works of Sutherland (1940), Clinard and Quinney (1967), or later Braithwaite (1984) and Punch (1996), all have an emphasis on the cultural transmission of practices which aid criminality. However, according to Hall (2012) this underlies a deeper core and pervasiveness in the social structure which drives practices of “predatory control”.

Arguably, this is also where Lange’s (2016) discovery of strategic ignorance is best located. Namely, she shows that the organisational structure of HFT firms is set up in such a way to avoid anyone getting a full view of trading strategies and the algorithms which contain them, reducing the risk of substantial amounts of codes and strategies being stolen and shielding those developing trading strategies from gaining a holistic understanding of the firm’s inner workings. This intense internal division of labour is known in SSF circles as the “black box”, “which refers both to the politics of not knowing the internal workings of a specific practice, and to the software package that contains the algorithms and executes the strategies” (Lange 2016: 3). As such, the “black box” is simultaneously a political-cultural phenomenon and a tool for rendering algorithmic practices invisible. Importantly, this structure of not-knowing (i.e. structures intended to divide, obscure, and protect knowledge) also gives rise to new practices of imitation, whereby traders mimic the “black box” as an organisational and industry structure. At this point, it already becomes apparent how a strategic “will to ignorance” within bureaucratic organisations can become an asset in questions of accountability (McGoey 2007). Unlike Karstedt and Farrall (2006) who found a lack of trust, fear of marketplace victimisation, and legal cynicism in their research, this should not be referred to as a “syndrome of market anomie”. In line with Hall’s earlier suggestion, the social structure of the market itself is anomic in its drive for practices of “predatory control”.

MacKenzie (2005) – whose work inspired much of Science and Technology Studies (STS) since the 1980s – calls for the opening of such “black boxes” to gain intellectual, political, and policy insights into the ways they are regarded as too technical or otherwise impervious for non-specialists to penetrate. Instead of falling into the trap of complexity, he advocates for a science studies approach to global finance, which emphasises the performativity of financial economics. From such work it is clear that the market is not simply an object of knowledge for economists to study and explain, but the two make up part of an integrated system of calculation, leading to levels of complexity which renders both prices and models untrustworthy (Davies/McGoey 2012). This presents a situation of epistemic uncertainty not unlike that described by Lange (2016), but also Coombs (2016) who shows how HF traders may not be able to explain the activities of their own algorithms. When Lash (2007) points to the “power of the algorithm”, this should be taken seriously for HFT as well by examining how their algorithms create epistemic uncertainty, benefit from it, and actively put it to use.

In another contribution of the before mentioned special issue on HFT, Lange, Lenglet and Seyfert (2016) summarise that the papers within all deal with an aspect of epistemic uncertainty. Further to previous considerations of both political-cultural and technical/algorithmic “black boxes”, this reality is manifest in particular through Coombs’ (2016) conclusion that regulatory representations of financial practices do not need to be accurate for them to be useful. In light of regulatory agencies’ limited resources, the suggestion is broadly that tolerance for inconsistency and representational uncertainty is required, especially when regulatory tactics can help detect attempted market manipulation. Regulatory tactics such as algorithm-tagging – a rule requiring firms to numerically identify/label algorithms which generate a trading decision (Hessisches Ministerium für Wirtschaft, Energie, Verkehr und Landesentwicklung 2014) – are broadly intended to enable trade surveillance to know the market, but lead instead to new mechanisms of compliance and enforcement. Coombs uses Callon’s (1998) original concept of “performation” here, to describe the manner in which market devices both record and shape the reality they are meant to measure. This is described as not only producing imperfect representations of algorithmic activities, but having the unintended side-effect of revealing algorithmic "black boxes", which nonetheless remain partially closed due to firms' divisions of labour as described earlier (see Lange 2016).

Speed and regulation: the dynamic emergence of HFT

It is clear, that epistemic uncertainty, established through political-cultural and algorithmic "black boxes", is an object of desire which creates bureaucratic advantage and problems with accountability. SSF scholars address this in studying these "black boxes", drawing on the performativity of financial markets and algorithmic practices, which leads to Coombs' "what works" approach to financial regulation. However, more than this strategy to expose some of the internal workings of "black boxes", these insights highlight an epistemic abyss described by Baudrillard (1996) as the "perfect crime" and, in light of the "black box" terminology used amongst SSF scholars, perhaps more suitably named a "black hole" (Virilio/Lotringer 2002).

As mentioned earlier, invisibility and perceived ambiguities can lie at the heart of corporate misconduct, and according to Wilson (2012) the Virilian "black hole" and Baudrillard's "perfect crime" both describe an event which renders the murder of reality invisible and whose nature exceeds our collective instruments' measurement capacity. Quoting Baudrillard he explains that the "perfect crime" entails "the transformation of all our acts and all events into pure information" (1996: 25). For criminologists this is important because more than the invisibility of corporate misconduct, it speaks to the disappearance of "crime" itself as an effective normative category. This bears a striking resemblance to the emergence of HFT as it similarly exceeds the capacity of regulatory tactics to measure their true activities and even HF traders themselves cannot always predict the activities of their own algorithms. However, the transformation of financial markets to increasingly adopt automated HFT algorithms is certainly not complete. As Lange (2016) notes, due to a high-tech environment with ever-increasing reliance on speed, practices of imitating other traders' and firms' tactics remain remarkably human. Not only does it require human interaction to find out what others are doing in the market, but cultures of HFT are heavily reliant on a code of conduct whereby ignorance is seen as necessary and accountability is constituted by not-knowing (see Lange 2016 and Lange/Lenglet/Seyfert 2016).

While Baudrillard (1996) merely speculates about the transformation of all substance into energy and ultimately into pure information, it is clear that the wide-spread phenomenon of epistemic uncertainty is grounded in the desire to overcome human emotions and their unpredictable impact on trading decisions. It is worth drawing on Kahneman (2011: 216) here, who claims that the financial industry suffers from a deep-seated illusion of expert skill in trading decisions. He adds further that algorithms are superior to experts when making decisions, especially in an environment of great uncertainty requiring reliable judgements of complex information. As a result, to maximise predictive accuracy, final decisions should be made by algorithms, because, unlike humans, they are unaffected by emotional evaluations such as an overconfidence in intuition. Similarly, Borch and Lange (2016) point out how the legitimacy of HFT and other forms of algorithmic trading relies heavily on their apparent superiority in executing orders efficiently. In this sense, algorithms are seen to overcome the emotional dimension of trading activities and the concomitant tendency to follow crowds or waver to emotional judgements and indecisiveness. This rational to transcend human emotions is motivated by the promise, frequently expressed amongst HF traders and others in algorithmic cultures more widely, "that objectivity and profitability can be realized through the use of numerical codes and material infrastructures" (Lange/Lenglet/Seyfert 2016: 161).

Hitchcock (2014) introduces the concept of "subjectlessness" here, which characterises the aspiration and promise of capital accumulation without the meddlesome interference of human decision-making. So far, the focus has been primarily on the sociotechnical dimension of HF and algorithmic trading, without considering the structural and institutional context in which it emerged. Namely, HFT is not merely a coincidental or inevitable by-product of technological advancement, but as MacKenzie (2014) demonstrates, engendered through processes of change in "linked ecologies"[1] (Abbott 2005). Although this approach is initially uncomfortable with structural determinism – perhaps unsurprisingly, considering the focus on performativity of markets – this can be avoided, if the ecological structure is thought in dynamic tension between two broad regulatory functions. Horsley, Kotze and Hall (2015) show that market societies depend on the simultaneous repression and sublimation of physical violence and interpersonal violation to the more pacified forms of functional aggression characterised by competition for symbols of wealth and status. Bearing in mind that neither chaotic and violent nor excessively pacified conditions provide the functional circumstances for capitalism to advance in, the authors propose a third space of "orderly disorder" which works to promote and harness the dynamic tensions between pacification and stimulation.

In this vein, regulatory regimes which have developed around market capitalism are not simply conducive to creating a "disciplinary society" (Foucault 1991) or a "culture of control" (Garland 2001). Nor are capitalism's reoccurring crises the result of regulatory withdrawal – often falsely described as deregulation – in order to stimulate a faltering financial and economic system. Instead, it is more accurately described as the financialisation of markets and State in-

1 When Abbott refers to a "set of social relations as an ecology [he] means that it is best understood in terms of interactions between multiple elements that are neither fully constrained nor fully independent" (2005: 248).

stitutions (Panitch/Gindin 2012), which aids to stimulate the global financial system through regulation induced incentives for innovation – for example, the dissolution of barriers to price competition and market entry. The shift of the States' role to ensuring the smooth functioning of credit allocation and the financial system as a whole follows regulatory arrangements in the 1970s and 1980s, which challenged existing hierarchies of privileged interest (Moran 1991) and club governance (Moran 2003). With the onset of the "regulatory State", characterised by the rise of regulatory agencies, regulation took on the function of safeguarding against scandals and managing upcoming crises in what has become an inherently volatile financial system (see Moran 1991, Panitch/Gindin 2012; Kane 2009). While often conceived as strategies of deregulation, this is based on a misunderstanding of the relationship between States and markets as opposing forces (MacKenzie 2005; see also Vogel 1996). Quite the opposite, markets do not exist independently or external to regulation, States, and non-State governance (see Schneiberg/Bartley 2010; Riles 2011). Moreover, it is precisely because of the sheer volume of regulation in financial markets that regulatory innovation became a key dimension of capitalist strategies and investment (Panitch/Gindin 2012).

These regulatory characteristics, which ultimately provided the seedbed for the subprime mortgage crisis in 2007-08 and the ensuing government subsidies in the form of bank bailouts (Kane 2009), have since developed into a drive to control systemic risk by enhancing regulators' knowledge of international financial networks (IMF and FSB 2009, see also Coombs 2016). While directed primarily at monitoring credit cycles and excessive risk-taking, but also securities markets by moving to regulatory knowledge practices based on private sources – i.e. calls for increased market transparency to prevent failure of firms (Dorn 2012) –, transparency requirements are brought in for trading technologies as well. There have been a number of destabilising market events connected with HF and algorithmic trading, including the 'Quant Meltdown' in 2007, Knight Capital's misbehaving algorithm which cost them $400+ million in August 2012 (Kirilenko/Lo 2013), but most famously, the 'Flash Crash' on 6 May 2010, causing a nine percent drop of the Dow Jones in a few minutes. With pre-existing sensitivities to emerging risks following the global financial crisis, it is perhaps unsurprising that these events would have instigated additional rule-making for algorithmic trading activities (Coombs 2016).

However, Engelen et al. (2012) question the benefit of addressing issues of market instability through technical interventions and technocratic oversight, suggesting that instabilities are not the mere by-product of isolated sociotechnical malfunctioning for experts to identify and fix. Such an approach lacks any consideration of the limits of technocratic control and ignores institutional failures. In a similar vein, the suggestion that "knowing actors" who are aware of the consequences of their actions, but operate in the context of distorted incentive structures (i.e. "moral hazards"), is problematic on two fronts. First, the assumption is once more that technical reform – in this case of remuneration structures – will restore market stability, and second, that experts – whether market actors or regulatory and political elites – possess special knowledge deployed in a self-interested manner, while fully conscious of their actions' inevitable costs. This neglects the possibility that elite politicians, bankers and by extension, traders and other market actors, could have agency without fully understanding the nature and consequences of their actions. Indeed, while Tett (2010) discovered institutional silences, MacKenzie (2010) claims that organisational divisions of labour created arbitrage opportunities by facilitating clustered evaluation practices of asset-backed securities (ABSs) and collateralised debt obligations (CDOs). Hence, the emphasis on technical interventions through new regulatory knowledge strategies to create more transparency is misguided in its fundamental misjudgement of financial innovation (Engelen et al. 2012).

As stated earlier, markets do not exist separate from regulation, States, and non-State governance, but are constituted in the interplay between the three. In this way, financial innovations can only be understood in the context of regulatory regimes which induce and stimulate innovation, while adopting technocratic oversight and interventions geared towards transparency in order to safeguard against scandals and future financial crises. This "maintenance of orderly disorder" – as described by Horsley, Kotze and Hall (2015) – can also be found in the emergence of HFT. Although, not depicted in such a way by MacKenzie (2014) his approach to explaining the growth of high-speed and algorithmic trading in three particular markets, suggests a similar tension between stimulation and pacification. For MacKenzie (2014) the way to understand the historical sociology of HFT is in terms of "linked ecologies" whose interactions are neither fully constrained nor fully independent. While not operating in isolation or fully determined by social structural forces, this framework taken from Abbott (2005) allows MacKenzie to consider the emergence of HFT as growing out of "linked ecologies" between HFT practice, trading venues, and regulation. Such ecologies should not separate between social and technical actors, and remain flexible about the topology of their historical interaction. In the case of HFT this means that an activity which in its infancy remained largely enclosed in specific trading venues and shaped by their wider structural characteristics has since come to take on a primary role in shaping trading venues themselves.

What is important here is that HFT practices are ultimately seen to be shaped in the interplay between historical processes, "linked ecologies", and "boundary work" (Zelizer 2012; see also Gieryn 1983, 1999) – a process of creating distinct categories of social relations, while marking boundaries between appropriate economic transactions. Ultimately, this means that trading venues will endeavour to distinguish between "good" and "bad" algorithms, just as within HFT praxis efforts are made to mark off apparently legitimate algorithmic action from other forms of HFT. Such demarcations can range from accusations of preying on institutional investors' execution algorithms – algorithms designed to put into action trading activities while also hiding them from other market actors – to distinguishing between liquidity-taking and liquidity-making algorithms. However, such designations are not only difficult to discern and contested, but often determined algorithmically for the sheer quantity of data that needs to be analysed (MacKenzie 2014). It would be possible to go into much greater detail to describe a full range of algorithmic trading activities as well as various modes of "boundary work", but this goes beyond the scope of this article and ultimately, distracts from the more important question how the interlink between regulatory governance and "boundary work" shape the nature and practice of HFT.

In the case of regulation, Castelle et al. (2016) find that the automation of markets, causing disruptions to the exchange industry, grew out of a combination of technological and political change. This confirms, on the one hand, MacKenzie's "linked ecologies" and on the other, introduces the importance of technological developments and processes in the emergence and shaping of HFT. Castelle et al. (2016) identify a historical trajectory brought about by the automation of trading systems, leading toward securities exchanges operating as for-profit public companies with ownership by non-members. With costs for executing transactions drawing near zero and the growth of HFT, exchange platforms' role in facilitating transactions has been substantially changed and disrupted. In combination with regulatory changes, which approved alternative execution venues – by switching from the definition of an exchange as a place which brings together buyers and sellers to a place which brings together orders – this put into place a legally sanctioned technological shift. As Lange, Lenglet and Seyfert put it:

> "This contributed to an exponential growth in the popularity of electronic trading, and led to a shift from trading floors to computerized trading and, ultimately, to trading floors and computer-based trading platforms being pitted against each other in a competition for speed of execution." (Lange/Lenglet/Seyfert 2016: 159)

The subject of speed is taken on by Lenglet and Mol (2016) who address it from the point of view of "regulatory abstracting" – a process ensuring compliance according to formal regulatory requirements while retaining the advantages of high-speed materiality – ultimately, hindering regulators' ability to adequately monitor and control financial markets. Algorithms increasingly take over as mediators of financial trade as well as regulation. This means that regulatory requirements of identifying and categorising algorithms are largely delegated from humans to computers and specifically, onto abstractive devices. Due to the competitive drive for ultra-low latency of market access, these are compelled to allocate computing power economically by assigning a single identification (ID) to all executed trades. In this way, it is possible to achieve trading compliance according to the letter of regulatory demand, while keeping material speed advantages intact. Importantly, the drive for ultra-low latency is itself accelerated through regulatory purification, increasing the likelihood of systemic failure or "normal accidents" (Perrow 1999, 2010).

HFT as a criminogenic phenomenon

The dynamic tension between financial regulation, technological enhancement and change, and innovation, fits well with an expanded formulation of Passas' (2000) "criminogenic asymmetries". This broadly refers to a situation in which conventional demarcations of legitimacy are dissolved, while legal and illegal actors begin to imitate each other's practices. Given Lange's (2016) earlier discovery of practices of imitation in HFT, harmful practices in financial markets can potentially lead to contagion and ultimately epidemic (see Orléan 1989; Haldane/May 2011; Kolb 2011; Sornette/von der Becke 2011). Importantly, this does not facilitate financial markets bypassing the State's regulatory institutions. Instead, asymmetries constituted in automated and high-speed finance are the product of excessive emphasis on the side of stimulating innovation and growth as opposed to repression. Indeed, Horsley, Kotze and Hall (2015) suggest that this imbalance is not only frequent in Western legal systems but an integral aspect in creating a regulatory third space of "orderly disorder" to ensure that the current economic system remains viable. Importantly, this process is undialectical in that it remains in dynamic tension without eliciting any politically relevant change. Indeed, according to Wilson (2012) a non-dialectical re-conceptualisation of capitalism is essential in so far that Marx' analysis of space/time compression can be updated with the Virilian concept of "speed politics". In this sense, speed is not a mere by-product of annihilating space with time – that is, overcoming the onto-materialist barriers of geographical space – but the disappearance of truth by differentiating between transportation and communication as two distinct velocities of movement (Wark 1994: 221). Put another way, the velocity of labour, materials, commodities, or capital in material form is not in the same category as that of money, information, and the infinite movement of capital.

In its drive for high-speed transactions and ultra-low latency, HFT should be conceived as a criminogenic phenomenon governed by speed and simulation. Therefore, epistemic uncertainty in regulatory processes, compliance, and imitation are not simply derivative to this "high-velocity" phenomenon, but the result of a criminogenic environment facilitated by speed, effectively disappearing practices of marginal legality into acceptable institutional praxis (see Wilson 2012). However, this is not to say that HFT as a matter of simulation – insofar that real and virtual reality become inseparable – operates in a state of lawlessness and complete immateriality. In line with Hitchcock's "subjectlessness" – described as "the new anomie (or normlessness) of capitalism's sublime" (2014: 148) – it works on the promise of speed which is supposed to transcend human inefficiency, physical space, and regulatory barriers. Accordingly, regulation does not disappear altogether, but constitutes the rules of the game. Where rules might traditionally be thought as either "constitutive" (enabling entrance to the playing field) or "regulative" (regulating activities on the playing field), Lash (2007) introduces "generative" rules to account for the capacity of algorithms to shape social, cultural, and economic arrangements. In the case of HFT, this can be observed first, in the way that the speed of algorithms eclipses the human capacity of perception, unless presented in a decelerated visual simulation (see Gongloff 2013). Second, divisions of labour organised through algorithmic and political-cultural "black boxes" create arbitrage opportunities while accountability is constituted by not-knowing (Lange 2016, Lange/Lenglet/Seyfert 2016; see also McGoey 2007).

The third dimension of this involves processes of "boundary work", which themselves are largely algorithmic, and serve to legitimate HFT as such by drawing boundaries with reference to trading algorithms designated as inappropriate (MacKenzie 2014). While it is tempting for criminologists to frame this as "techniques of neutralisation" (see Karstedt/Farrall 2006; Lord/Levi 2016), it is more suitably described as "fetishistic disavowal" – in this case, in the form of sociotechnical mechanisms which demarcate and disavow the Real[2] of capitalism's harmful dynamics (Hall 2012). For Hall (2012) this means that systemically harmful dynamics are distinguished from a core of consensual (criminalised) harms and thus excluded from criminology's field of interest. In this vein, "crime" disappears as an effective condemnatory and normative category. While these sociotechnical practices are increasingly automated, HFT should not be misconstrued as a fully automated and entirely post-human process. In fact, for Hitchcock (2014) human subjectivity is only bracketed temporarily in those microseconds in which value is realised. The moment subjectivity is reconstituted the sublime promise of unlimited post-human accumulation, signified by high-speed algorithmic technology, is revealed as an impossibility. Characterised as the "quest for discipline", Borch and Lange (2016) demonstrate that trader subjectivity takes on new forms with the rise of HFT. They identify several techniques used among HF traders to combat emotionality, which broadly deal with predictability, identification of historical patterns, emotional detachment from algorithms, prudence in risk-taking, and an ethos of systematic research. In this vein, they describe an HF trader subjectivity which aspires for discipline achieved through an overload of complexity or the elimination of emotions.

This is important, in light of Dean's (2012) illustration that complexity in global finance functions as a privilege for banks and financial firms by displacing accountability onto knowledge. Namely, in pointing to the complexity of finance, crises and destabilising market events are diminished to the status of "normal accidents" (Perrow 1999, 2010), disavowing the role of financial institutions in the market while nonetheless enjoying the benefits of complex financial instruments and algorithmic trading strategies. Hence, the only

2 Hall (2012) uses the Lacanian Real of unsymbolised drives which are stimulated and made functional for capitalism's socioeconomic exchange relations and its culture of exploitation, envy, and enjoyment.

imaginable recourse left is to implement more of the same political-economic policies. Such cynical reasoning has already been described by a number of cultural theorists, philosophers, sociologists, and criminologists (see Žižek 1989; Fisher 2009; Davies/McGoey 2012; Hall 2012; Hall/Winlow 2015), which sees no desirable or feasible end to the capitalist mode of organising the economy. At the same time, discipline as an expression of rationality and neutral knowledge fits in well with Žižek's (2004) portrayal of the Lacanian "university discourse". As a specific mode of subjectivity, it stands for the human agent reduced to the "interpassive" role of the observer and executor of "objective laws" (see also Žižek 1998). Thus, the drive for complexity and discipline both work to aid the broadly systemic and systematic disruption of subjective reasoning, which serves to transform humans into the "passive barbarians" (Mumford 1951: 16; see also Fromm 2002) used as instruments in the exploitation for others. In this anomie of capital accumulation through "subjectlessness", criminal activities and processes of marginal legality are not legitimised by cultural pressures for wealth and status, but fetishistically disavowed in the form of sociotechnical "interpassivity".

Conclusion

This article aimed to place the emergence of HFT in a criminological perspective which reaches beyond "technologies of control" and explores instead how sociotechnical arrangements contribute towards the constitution of criminogenic asymmetries and new anomic conditions. In the first instance, it is clear that the "black box" as a metaphor for the technical complexity of algorithms and organisational measures of not knowing the inner workings of specific practices works to contribute to the creation of epistemic and regulatory uncertainty. The increasing automation and acceleration of trading activities, is not only a challenge to regulatory tactics to measure and monitor the true activities of algorithms, but this development is itself motivated by a view that algorithmic technology will ensure profitability and objectivity without the interference of human decision-making. This drive for speed and ultra-low latency, while certainly not complete in transcending human involvement, serves to delegate final decisions onto algorithms leaving human traders to adopt new forms of disciplinary practice.

Importantly, these developments towards automation and acceleration are not merely coincidental by-products or natural outcomes of technological advancement, but emerge out of the dynamic tension between two regulatory functions; pacification and stimulation. In what has become an inherently volatile financial system, regulation since the 1970s is characterised by adopting technocratic oversight and interventions geared towards transparency, in order to safeguard against scandals and recurring financial crises. More recently, with sensitivities to emerging risks following the global financial crisis and a number of destabilising market events connected with HF and algorithmic trading, there have been calls to augment regulatory knowledge practices, which itself provides a key dimension of capitalist strategies and investment in the form of regulatory innovation. More than deregulation as the withdrawal of the State from financial markets, regulation is best seen as constituting the rules of the game. Similarly, algorithmic rules work to generate social, cultural, and economic conditions which benefit capitalist power. The sociotechnical drive to transcend human emotionality and thus exclude humans from decision-making processes suggests a kind of technical sublimation, which remains human in the form of disciplinary practices pursued through an overload of complexity and the elimination of emotions.

This drive for "subjectlessness" – the promise of nonhuman capital accumulation – contributes to the systemic disavowal of accountability and moral responsibility by transforming humans into "interpassive" automatons concerned primarily with the apparently objective management of trading algorithms. Furthermore, high-speed and automated finance comes with technical and organisational divisions of labour, which create practices of not-knowing and conditions of epistemic uncertainty. In order to evaluate HFT practice, processes of largely algorithmic "boundary work" legitimate HFT in general by creating lines of moral delineation. Importantly, these conditions of normlessness do not simply obscure. Rather, the very drive for unlimited and unrestraint accumulation creates practices which demarcate and disavow this reality. In this way, HF and algorithmic trading make up a criminogenic phenomenon, but not by legitimating practices of marginal legality through cultural pressures for wealth and status. Instead, via sociotechnical "interpassivity" the drive for "subjectless" accumulation serves to fetishistically disavow the Real of capitalist power and its harmful dynamics.

In light of this, criminology's engagement with sociotechnical approaches should include further consideration of their structural role in political economy and institutional practices of ethical disavowal. By reconceptualising "technologies of control" as one side of a dual tension between pacification and stimulation, sociotechnical practices may be seen effectively as virtually disappearing criminal activity and processes of marginal legality into apparently legitimate institutional praxis (see Wilson 2012).

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