'Business Code/Spaces' in Digital Service Firms:

The Case of Online Multinational Fashion Retailing

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Abstract

The impacts of digital technology on the spaces and practices of firms are of increasing concern, yet we know comparatively little about how emerging digital business models affect the 'business spaces' of service firms. We draw on case study research within five leading online fashion retailers to identify interweaving virtual and physical spaces of online retailing that are expressed through *intra-* and *inter-firm digital interdependency management*. This allows us to build a conceptualisation of the 'business code/spaces' of digital service firms, i.e., the entanglements between virtual, information-rich and responsive networked infrastructures, and materially and socially situated infrastructures. The conceptualisation of 'business code/spaces' reveals how combinations of embedded interpersonal decision-making within office-based work communities, networked partners, their established processes and bureaucracies, as well as the physical restrictions of space and place together reproduce spatial fixes and local-global geographies, but in ways fundamentally defined by digital technologies and business models. Our conceptualisation of 'business code/spaces', therefore, contributes to research examining the inter- relationships between 'the digital' and business practices as well as work concerning global retailing.

Keywords: business spaces; work communities; digital; online retailing; big data; decision-making

1. Introduction

Debates about the service economy have, in various ways over 30 years, examined how production and consumption considerations affect the locational determinants of firms (O'Farrell and Hitchens, 1990; Daniels, 1995; Bryson and Monnoyer, 2004). Well-documented relationships between service firms and cities (Beyers, 1992; Wood, 2006; Taylor et al., 2013) lie at the heart of an unequivocal rejection of 'end of geography' (O'Brien, 1992) and 'death of distance' (Cairncross, 1997) hypotheses. Most recently, debate has, therefore, moved on to consider the intersection of locally-bound and globally-stretched networks. This includes a focus on the embeddedness of the global production networks of service TNCs (Coe and Lee, 2013; Burt et al., 2017), the combination of local buzz and global pipelines in knowledge management (Bathelt et al., 2004; Faulconbridge, 2006, 2010) and political and strategic aspects of internationalization in particular locations (Taylor et al., 2013; Hall, 2017).

Existing studies provide rich accounts of clients/customers (Faulconbridge et al., 2011; Jones and Search, 2009), collaborators/suppliers (Sassen, 2012), team members (Grabher, 2004; Jones, 2007) and institutional contexts (Goerzen et al., 2013) as mechanisms which determine the local-global 'business spaces' (Jones, 2009) of service firms. By adopting the term 'business spaces', Jones (2009: 204) highlights 'that there is a need to conceptualize the nature of business space beyond a focus on physical offices, factories or other production facilities which are located in demarcated places or territories'. In particular there needs to be attention focused on 'four spatial 'fields' – material, social, organizational and virtual – to conceptualize how the built environment, firms, technology and mobile social actors are all constituted through increasingly complex spatialities' (Jones, 2009:204). We adopt the 'business spaces' perspective here as a way of understanding the local-global spatialities of business practices in digital business service firms – that is to say, the spatialities of routine actions and interactions of those producing and delivering services (Jones and Murphy, 2011). In particular, we extend the 'business spaces' concept to address a significant theoretical gap in existing literatures in terms of understanding how the latest generation digital technologies – including 'big data' and automation – have transformed the spatiality of service firms.

The effect of digital networks and 'big data' on economic and social life is of increasingly concern for economic geographers, having had profound effects across industry and society more broadly (Dodge, 2017). For service firms, this relates to more than the well-documented relationships between business travel and video-conferencing (see Faulconbridge et al., 2009). Digital information and connectivity are important facilitators of efficiency and communication but also offer entirely new business models and ways of working (Ash et al., 2018). Such changes have consequences in terms of the provision of finance, technology and labour (Currah, 2006; Zook, 2005), and more fundamentally in terms of the constitution of socio-spatial practices. Kitchin and Dodge (2011) use the term 'code/space' to refer to such mutual constitution of software and the spatiality of everyday life. They argue that digital infrastructures and software do not, as existing 'business spaces' literatures tend to presume, attend to already existing socio-spatial practices, e.g. using the internet to coordinate activities with already established suppliers. Rather,

digital infrastructures and software constitute new spaces that are attended to through new practices. For economic geographers, this implies the need to better theorize how a new generation of digitally mediated service firms might have developed distinctive 'business spaces' as a result of the 'big data', automation software and virtual infrastructures available to them. Hence, the theoretical motivation for this paper is the question: *How do digital business models affect the 'business spaces' of service firms?*

This paper address this question by exploring one service sector that has been profoundly affected by online and wider digital technologies, the retail industry. Traditional, store-based retailing is a richly geographical process that involves locating, embedding and operationalising dispersed store networks, managing both international and domestic supply chains, handling regional logistics networks, and, in the process, interpreting a wide range of codified and tacit knowledge to inform strategy and execution (Currah and Wrigley, 2004; Wood et al., 2016; Wood and Reynolds, 2012a). Yet, the advent of e-tailing, along with the related development of 'big data' and its associated analytics relating to consumers, competitors and merchandise, has arguably reconfigured the spatiality of retail networks. We, therefore, use original empirical research of five leading international online fashion retailers to examine the 'business spaces' generated by digital business models.

Theoretically, the contribution of this paper is to draw on the findings of our empirical analysis to advance the work of Jones (2009) and Kitchin and Dodge (2011) by theorizing 'business code/spaces'. 'Business code/spaces' are the geographies of firms adopting digital business models. These 'business code/spaces' are defined by entanglements between virtual, information-rich and potentially responsive networked infrastructures, and materially and socially situated infrastructures. We identify two key mechanisms through which 'business code/spaces' emerge: *inter-firm digital interdependency management;* and *intra-firm digital interpretation and decision-making*. In both cases, business practices – respectively, as part of external relationships such as with suppliers and third party retailers, and within firms' boundaries – are constituted through digital infrastructure and take-on related but subtly different characteristics to those reported in previous studies of non-digital business models and retailers. The theorization of 'business code/spaces' developed is important, therefore, because it provides a way to explain the intersection between the digital, the socio-economic and the spatial. Specifically, it offers new explanation of the importance of co-presence, proximity and thus rearticulated spatial fixes in service firms that adopt digital business models.

Our paper is structured as follows. First, we explore the ways in which economic geography has framed the relationship of 'the digital' with space generally and then specifically within retailing, before second reviewing the ways the discipline conceptualises issues of knowledge, interpretation and decision-making within communities in a digital world. Such insights adopt a multi-disciplinary perspective and draw on concepts widely discussed within the social sciences, including work communities, 'buzz' and knowledge management, all of which adopt a practice-based perspective. Third, we explore empirical evidence from our five case study retail firms before finally conceptualising 'business code/spaces'.

2. Service Geographies in the Digital Era

2.1 The impact of 'the digital' within economic geography

For Ash et al. (2018: 26) geography 'is in the midst of a digital turn', yet many of its effects are 'being thoroughly internalized and taken for granted'. Too often, focus falls on how digital technologies are used to serve existing practices, examples being the use of email and videoconferencing in teams and 'buzz without being there' (Gertler, 2008). Such an approach is now limited because virtual effects are woven within the physical, place-based reality of economic activity (Zook and Shelton, 2013). Hence, rather than framing the effects and 'stickiness' of space and place as simply being overcome, the challenge for economic geographers is to conceptualise the ways in which real time information flows and digital technologies affect consumption and work practices which 'are entwined in everyday economic activities' (Foster and Graham, 2017:70) and indeed constitutive of those activities.

In responding to this challenge, questions arise about the way industries have been irrevocably reshaped by the effects of digital technologies. A reduction in barriers to entry to markets, the disintermediation of traditional suppliers, access to a potentially global digital labour pool and the empowerment of consumers through accessibility of information and new mediums of distribution are all noted as potential impacts (Crewe, 2017; Graham and Anwar, 2018; Leyshon, 2014). However, this sits alongside questions about the industries that might conceivably be at the forefront of the digital revolution and apparent continuity in spatial fixes. For example, Zook's (2005:3) extensive study of Silicon Valley in the 2000s suggested that 'the rhetoric of "spacelessness" became increasingly difficult to reconcile with reality', as tacit knowledge, proximity to venture capitalists and concentrations of industry specific skilled labour underpinned agglomeration and proximity (*cf.* Leyshon's [2014] assessment of the geography of the digital music industry).

Even in sectors such as finance where investors enjoy access to foreign stock markets through ICT without the requirement of physical mobility, recent work on mutual fund flows has found that geographic proximity is more important than institutional and cognitive proximities in determining the location of mutual fund investments (Lavigne and Nicet-Chenaf, 2016). And therefore:

> …the death of distance has been considerably exaggerated, as distance and its attributes (geography, institutions, language, culture) still affect the asset flows of mutual funds. Even if globalization and ICTs have reduced physical market transactions, transactions remain tied to distance in all its forms. (*ibid.*, 2016:340)

Considering digital effects thus 'matters because it alters the conditions through which society, space, and time, and thus spatiality are produced' (Kitchin and Dodge, 2011:13). Hence, Kitchin and Dodge propose using the concept of 'code/space' to capture the interdependencies between digital technologies and spatiality. This means taking account of how digital technologies 'have contingent, and diverse, effects through the ways they become linked into specific social contexts by linked human and technological agency' (Graham, 1998:178). Consequently, the emergence of digital technologies poses complex questions for economic geographers regarding the spatiality of digitally mediated economic

practices. Jones (2009) advocates a conceptual approach that recognises four socio-spatial fields – material, social, organizational and virtual. For Jones, these fields are interdependent. Therefore, and pertinently for this paper, questions exist about the kinds of 'business spaces' generated by digital business models. How do the practices of digital service firms generate 'business code/spaces'? That is to say, how is the spatiality of business practice (re)constituted through the use of software, data and virtual infrastructures, as the material, social and organizational socio-spatial fields are co-constituted with, and not just served by the digital? Here we seek to grapple with this question in the context of retail as an exemplary service sector.

In adopting a focus on 'business code/spaces' we move away from questions about the locational determinants of the offices of digital businesses and towards a focus on how organisational spatiality is constituted by the practices of workers in digital businesses. As Yeung (2005) and Jones and Murphy (2011) argue, a focus on organisational spatiality, developed by understanding the practices of those conducting business in organisations, helps advance an alternative perspective to that offered by analyses of office/subsidiary location. In particular, it draws attention to how economic value and outcomes are achieved through forms of organisational spatiality tied to the practices, interactions and interdependencies of agents in firms (see also Faulconbridge, 2012; Vallance, 2011). Focussing on 'business code/spaces' in online retailers thus allows us to understand the extent to which digitisation transforms practices and the responses to such transformations.

2.2 Geographies of digital retailing

Digital retailing has had profound effects that have manifested themselves in an extremely short period of time. If we consider Euromonitor data on 79 countries, the past decade (2008-2018) has seen store-based sales increase modestly (10.1%) while non-store sales increased a remarkable 65.8% [1]. Market analysts Statista (2018) claim global e-commerce sales in 2017 were US$1,561bn and are forecast to increase to US$2,590bn by 2022. These impacts have been experienced in a number of ways. First, the rise of digital products as alternatives to physical commodities (e.g. e-books, MP3s) lend themselves to purchase and delivery instantaneously through virtual rather than physical networks. And, at the margins of legality, such innovations have led to digital peer-to-peer sharing in music for example that by-pass payment to retailers altogether (Richardson 2018). Second, the closely related advent of non-store or 'pure play' online retailers (e.g. ASOS, Amazon) has posed significant challenges for traditional store-based operators and offered a platform for extremely rapid international expansion that is seen as lower risk and more controllable (Coe and Wrigley, 2018). Virtual retailers can profitably offer for sale products that are in low demand and therefore uneconomic to stock in any conventional 'bricks and mortar' store—the so-called 'long tail' (Hracs et al., 2013). In addition, they exhibit price transparency and lack the need for sunk costs relating to operating and staffing store networks along with an associated proximate distribution and logistics infrastructure. This has led to the disintermediation of some traditional retailers

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[1] Using fixed 2017 exchange rates and constant 2017 prices sourced from Euromonitor Passport database.

and has, to some degree, compromised the relevance of physical consumption places and networks (Singleton et al., 2016). Third, beyond the rise of online retailing *per se*, the rise of digital technology and capabilities of information management have revolutionized the back office functions of the retail industry, creating lean and responsive logistics and supply chain competencies (Coe, 2013). Digital technologies have facilitated more intense and responsive relationships between partners throughout retail global production networks (Wrigley et al., 2005), but also, in some instances, provided the data interchange platforms needed to make outsourcing more practical and realistic (e.g. Aoyama and Ratick, 2007). Furthermore, 'big data' warehouses containing information on customers and their purchasing provide a rich source of location-based information that can inform on- or off-line retail marketing as well as store format and location strategy (Aversa et al., 2018; Wood and Reynolds, 2012b).

The digital revolution has had marked effects for the fashion retail sector in particular. Online business models incur only modest sunk costs in overseas expansion that have facilitated significant rapid globalization (Wood et al., 2019). For example, Deloitte's (2019) survey of the global top 250 retailers suggests that apparel & accessories retailers are in an average of 26 countries, compared to only 6 countries for Fast Moving Consumer Goods (FMCG) (typically food) retailers. Furthermore, the growth of social media and mobile commerce provides a virtual platform for digital marketing and brand building (Crewe, 2017). This has allowed brand narratives to shift from being unidirectional from the brand/retailer-to-customer toward empowering those consumers. This 'flattening effect' of ICT leads to rapid penetration of fashion fads and knowledge across diverse geographies (Weller, 2007). Crewe (2013) argues that social media is democratising fashion as established authorities (e.g. leading magazines and their journalists) have been usurped as the harbingers of key trends by influential 'blogging' consumers who attain a significant virtual buzz in their own right. Such investment in the strategic use of social media permits fashion designers and retailers to exploit the opportunities offered by virtual proximity rather than permanent geographic proximity within relevant markets (Brydges and Hracs, 2018a). Brydges and Hracs (2018b) further note that 'virtual mobility' is also complemented by forms of 'temporary mobility' by designers and retailers physically attending fashion weeks for example as well as 'mediated mobility' which involves working with intermediaries to create an impression of presence in key markets.

2.3 Reconceptualising spatiality in a digital era

Digital developments in the retail sector require a rethinking of approaches to studying firms and their spatiality. Existing approaches that consider the embeddedness of firms need advancing to take account of dis- and re-embedding digital forces. In exploring the economic geography of retail distribution, researchers have developed conceptualizations of territorial, network and societal embeddedness (Hess, 2004) to explicitly frame our understanding of the relationship of the retail firm with host markets, particularly in international expansion (Wrigley et al., 2005). This has underlined the need for retail firms to engage with, respond to, and ultimately affect the heterogeneous economic, cultural and institutional

make-up of the places within which they operate – a process which itself varies dependent on the nature and characteristics of the retailer concerned (Burt et al., 2017). Clearly, the dynamics of this spatial fix are more intense when a retailer operates physical stores and employs staff in cross border geographies rather than operating virtually. Recent research into online retail TNCs suggests that, while exhibiting some evidence of investing in territorial embeddedness in different markets, they remain predominantly inward looking and dominated by their own home-country societal embeddedness which leads to more of an arm's length 'command and control' oriented approach to global online retail expansion (Wood et al., 2019).

Here we take a different approach, less focussed on the location of key assets such as stores, suppliers or consumers, and more focussed on the business practices involved in operating digital retail business models. Our focus on business practices builds on existing literature (e.g. Faulconbridge, 2012; Murphy and Jones, 2011, Vallance, 2011) that highlights the importance, as part of efforts to understand the spatialities of service economies, of analysing the routine actions and interactions of those producing and delivering services. Business practices are the everyday activities, such as negotiating, learning and, resistance, that influence how a firm operates. Our interest here lies, therefore, in the way business practices are shaped by the digital DNA of online retailers, with such practices producing the 'business code/spaces' that define the geography of digital service firms.

Exemplary of the importance of focussing on the practices producing 'business code/spaces' is the way 'big data' affects knowledge and decision-making in firms. One of the principal challenges within retailing is managing and interpreting knowledge relating to customers and competitors, which in turn informs the nature, speed and location of decision-making concerning product ranging, sourcing, logistics, merchandising, price management and service levels. These broad themes have been explored in previous research, in terms of mediating between codified knowledge and tacit knowledge (Wood and Reynolds, 2012a; 2013). Wrigley and Currah (2006:349) emphasise a 'decentralized geography of organizational learning in the retail TNCs [which] means that knowledge management is vital to the competitive advantage of these firms'. In the context of the digital revolution in retail, the 'big data' now available and the other changes associated with digital business models potentially reconfigure business practices, and specifically the relational networks and communities of learning and decision-making in firms. Given this context, we pose the following empirical research question: *How does the digital nature of online fashion retailing affect 'business spaces'?* We address this question by focussing on the business practices of those working for online fashion retail firms, and then use the insights gained to build our conceptualisation of 'business code/spaces'.

3. Background to Case Study Online Retailers and Method

To address our empirical research question requires that we focus at the level of the firm but particularly on the micro-scale where these issues are confronted by managers in day-to-day work and where the possibilities offered by 'the virtual' are visibly seen to have specific implications across space and place (*cf.*

Jones, 2014; 2018). Such a perspective allows us to understand 'the interaction between cognition, context and behaviour' (Clark, 2007:197). We thus adopted a case study approach, using a sample of five leading fashion retailers. All are international operators and based in the UK – varying from less than £100m through to > £1.5 billion sales (see Table 1). The retailers were purposefully selected to ensure significant variation – from fast fashion through to formalwear – as well as pure player (online only) retailers (e.g. Retailers A; C) and omni-channel operators that operate stores alongside their online operations (e.g. Retailers B; E). Retailers B and E operate significant wholesale business alongside their own retail operations by selling merchandise to third party store-based and online retailers.

While all five online retailers operated internationally, their physical infrastructure and presence of staff has remained remarkably domestic in orientation. Typically, fulfilment of orders occurs from the UK host market rather than the provision of distribution centres or warehouses within overseas territories, though there are exceptions in Retailers D and E where there are accompanying store networks located overseas. In addition, head offices remain principally based in the home market, with only Retailer E commonly operating a head office function in each of its overseas markets, largely owing to servicing the demands of its stores. Instead, while Retailers A, C and D operate some overseas head offices, these tend to be very limited function and carry minimal authority for decision-making but are focused on influencing marketing trends and social media, rather than adapting merchandise and pricing.

[Table-1]

We conducted 55 semi-structured interviews with senior management of the five retailers between 2015-2018, including CEOs, directors of buying, merchandising, e-commerce through to lower level employees administering processes of price and merchandise planning and management. Mindful of the threat of seduction by corporate elites outlined by Clark (1998), we ensured our research consulted respondents situated across the organisational and corporate hierarchies of the firms. In doing so, we captured how issues were interpreted differently depending on seniority and one's space within the firm. Interviews lasted between 40 and 90 minutes and were typically audio recorded. The subsequent transcription generated more than 1,000 A4 pages of text which were then coded independently by two of the research team. To maintain the anonymity of interviewees, direct quotes are acknowledged through an interviewee number.

4. The 'Store-Less' Virtual Infrastructure of Digital Retailers

The fashion retailers studied were characterised by a number of key features associated with a 'store-less' business model and reliance on virtual infrastructures for engagement with consumers. This offered notable opportunities for high degrees of responsiveness that were – at first sight – disembedded from conventional 'business spaces' or established decision-making processes. First, constant comparison and adaptation to competitors defines large parts of the business model. This is most clearly illustrated by the

'real time' and continuous tracking of price changes at competitors' web sites (both markdowns and promotions). Such real-time data commonly included assortment information of competitors by product line and by price band, which aided an understanding of a retailer's own relative positioning. In conventional store-based retailing, senior managers historically relied on visits to physical store networks of competitors to keep track of rival strategies, yet all five online retailers studies utilised some form of 'web scraping' tool of competitor web sites. The tools were used to commission timely price movements and provide evidence upon which to amend prices and, sometimes, extract supplier funding support for price reductions – as executives at a fashion oriented department store noted:

> The price-matching tools [have] made a huge difference [which] emails you live alerts [regarding competitor price changes][…] That's made a huge difference in terms of us going to our suppliers to get support to get us to those prices (C26)

> We can trigger price really quickly, so, I mean, literally, if the guys spot it on a morning, the first thing they will do is make a price move. Some of the price moves, we will make, and recover the associated funding for that price move retrospectively (C16)

Second, while there were clear restrictions on the ability to merchandise fashion in an effective way online compared to physical space−for example where store display and assisted service can positively influence the consumer-product interface (Crewe, 2010) − the virtual medium offered some opportunities that were at the core of the firms' competitive advantage. One such example was the ability to amend the virtual geography of the web store and tailor the individual customer's virtual shopping trip. While the immersive retail theatre and marketing science underpinning fixed internal geographies of physical fashion store interiors are well known (Crewe, 2016), the virtual store permits *instantaneous* manipulation of product locations on web sites to increase/decrease its prominence. As one Merchandiser for Retailer A noted:

> If you re-price and leave on page 8 [of the web site] you wouldn't see any change. Move things up website to see sales uplift−sometimes that's all it needs. We'll do that with an item that comes back into stock from a supplier and is on a high cover, moving it up to page 3 on website will increase sales dramatically (A4)

Importantly, changes to the 'consumer shopping path' can be made in real time and selectively for specific shoppers – something far removed from the cost and disruption in adapting the physical interiors of bricks and mortar stores. Continued research and innovation in online merchandise placement and consumer shopping paths was a pressing focus of research by our retailers, with one even running an experimental lab within its head office where consumers were paid to attend in person and to be observed making shopping choices at online computer terminals.

Third, the 'pure play' nature of an online retail store offers the potential to cast off the traditional model of sourcing, pricing, ranging and stocking a store network. The traditional approach involves a spatially stretched global supply network for ranging stores (that have finite capacities given limited and

variable store space) with fashion merchandise that is designed and manufactured ahead of season, typically from the Far East on lengthy lead times, and complemented by more responsive sourcing networks from Turkey, Morocco and Eastern European locations for example (Tokatli, 2015). Indeed, '[h]igh volume manufacturers working at the leading edge of fashion change must place orders for fabrics and dyes perhaps a year in advance of the actual production season' (Weller, 2007:59). While such traditional trends *were* representative of the vast majority of retail firms we explored, fast fashion Retailer A was marked in using the real time information relating to customer behaviour to construct a so-called 'test and repeat' model. By sourcing circa.70-80% of its merchandise from the UK that avoided lengthy lead times, it could present a vast range of styles on its web site–far more than any physical network of stores could profitably offer due to space constraints–and then respond to customer demand on successful lines by commissioning further production runs in short order given a local sourcing network. As the Head of Merchandising for Retailer A explained:

> We've got a model here, which is a test and repeat model, where we buy quite wide in terms of our range width, but we buy shallow as well so we buy small [initial quantities] and we test it on site and let the customer tell us is it a winner or not, instead of traditionally where you build a range (A1)

Such an approach is revolutionary compared to traditional retail approaches that are beholden to stocking extensive store networks ahead of time and reliant on global sourcing networks. Rather, this trend is representative of a partial 're-shoring' or 'nearshoring' of clothing production that is facilitated by the availability of highly responsive virtually networked retailing (see Froud et al., 2018 and House of Commons Environmental Audit Committee, 2019 for analyses of the dynamic between supplier and retailer in these re-shoring arrangements).

The three key features of digital retailers' business models – constant price comparison and adaptation; the instantaneous manipulation of virtual store layouts; and a shift towards 'test and repeat' sourcing models–are all enabled by the use of 'big data' and virtual infrastructures. They are also associated with 'business code/spaces' that result from the business practices they inspire. We now turn to the nature of these practices and their role in the successful operation of digital retail models.

5. 'Business Code/Spaces' in Online Retail

In many respects, digital retailers face the same challenges as their 'bricks and mortar' counterparts, and as a result often rely on similar business practices. There are limitations to the virtual and disembedded nature of digital analytics. For example, in formulating a fashion merchandise range that was appropriate in terms of style and pricing, there was an awareness that decision-making must be informed by picking up the 'buzz' within the fashion market that could not be codified within data analytics. As a result, those working for digital retailers adopt multiple strategies to get outside of the firm and engage with potential sources of 'buzz'. For example, in Retailer C, merchandisers are intricately involved in business trips by accompanying the buyer to construct ranges through sourcing visits to the Far East:

> I work very closely with the Buyer on the area to make sure that we've got the right range framework to fit, and I travel twice a year to the Far East with the Buyer, where we try to build and manipulate the range out there (C17)

In addition, temporary mobility through physical visits to retailers and informal meetings at fashion events and trade shows are important – mirroring recent findings in other service sectors (see Faulconbridge et al., 2009). External networks feeding the organisation with tacit knowledge relating to trends were essential, as the Director of Wholesale for Retailer B suggested:

> We keep an eye on specific people and what they're doing and we get a lot of noise from buyers, whether it be independent stockists or others (B1)

Even when retailers expanded overseas, there was often a perceived need for small subsidiary head offices to be established with a skeleton staff to identify and influence local fashion styles and trendsetters – or as the Head of Merchandising for Retailer A put it 'to keep the talking on the street and in the press and the fashion arena [...] to keep that buzz going and to learn more and feed into us the competition, the trends' (A1). Such subsidiary head offices were also important for spreading knowledge and best practice back to the home market. This process was complemented by temporary co-location through business travel by executives from the home market. This was discussed in some depth in Retailer D in the case of their North American head office, particularly the need to visit and not rely solely on video conferencing:

> There's better movement between these two offices now…it's changing that mindset. It was always a big deal that someone would go over to New York, and now it's consistent traffic coming back and forth, because you're sharing everything and you're not until you start having those conversations. We do a huge amount of VCs [video calls] but it's just not the same […] We're speaking the same language, but we're actually still not. It can be somewhat challenging sometimes. (D1)

In addition to these business practices and associated spaces of work and knowledge that are common to all retailers, digital retailers do, however, rely on two important and distinctive business practices: *inter-firm digital interdependency management;* and *intra-firm digital interpretation and decision-making*. Each of the practices contributes in different ways to allowing constant price comparison and adaptation, the instantaneous manipulation of virtual store layouts, and a shift towards 'test and repeat' sourcing models. In the next two sections we, therefore, outline the characteristics of *inter-firm digital interdependency management;* and *intra- firm digital interpretation and decision-making* practices. In the concluding section we then consider how these mechanisms, which are constituted by digital technologies, are generative of the 'business code/spaces' of online retail firms.

5.1 Inter-firm digital interdependency management

Existing literatures document extensively the interdependency between retailers and their suppliers (Perry and Wood, 2019). In digital retail business models, these interdependencies have new dimensions – for example, where they are associated with the management of price adaptations. The capability of expert systems that provide real time 'scraping' of competitor online retail price data to inform 'immediate' online price adjustments has to be coupled to effective ways of managing inter-firm network relations with suppliers of the products whose prices are being adapted. These were neatly summarised with respect to making a price change by a buyer in Retailer C:

> Anybody can change a price, because that's very easy. [...] [But] how is that going to impact on decisions you've already made on promotions you're already doing? [...] How is that going to impact on a commitment you've made to a supplier for volume? [...] I wish I could just press a button and it worked it out for me and came back and said, "Yeah, you can do that" but you can't (C12)

The impacts on/of suppliers can take a number of forms. First, where the online retailer was selling a branded product from a manufacturer which had become uncompetitive on price, there was sometimes a perceived need to ensure any price reduction was funded to some degree by that manufacturer. Second, there were wide ranging implications of price changes on customer demand which placed a burden on the physical logistics and distribution system. This was especially onerous for product lines which were not housed within the retailers' own distribution centres typically located within the UK (even in the event of overseas orders) but instead within manufacturers' facilities for direct-to-customer delivery. Long term planning, which is the hallmark of such inter-firm relations, contrasts markedly with the quick response informed by real time data that would otherwise be pursued:

> It's also about aligning it operationally with the contact centres and the DCs [Distribution Centres], making sure they're aware of the volume spikes that are coming in, so they can manage the delivery promise (B29)

> I think every price change would have an impact on something, so you have to make the Merchandising team aware that you are moving these prices [...] So, if I do something on a DD [direct delivery] product, how is that going to impact something we bought a lot of in stock? [...] It's "I've got the funding, I can do it – are we all comfortable with me doing this before I do it?" (C12)

Retail executives exhibited a sense of obligation for managing stock, even if it resided outside of their logistics infrastructure to ensure continued good inter-firm relations with any manufacturer partner:

> [The relationship] wouldn't last very long if every time that something didn't sell, we just walked away from it, because the distributor would just have a massive markdown pot of stock themselves, so we have to continually tri-party collaborate with the OEM [original equipment manufacturer], the distributor and ourselves to agree plans to move volume through (C26)

Third, while all five online retailers leveraged B2C [business-to-consumer] sales as their core business, Retailers B and E also relied on revenues from B2B [business-to-business] relationships−particularly through the sale of fashion apparel to third party retailers on a wholesale basis. This posed significant challenges in terms of managing these inter-firm networks and achieving consistency with their own online and store-based offers−something which necessitated close relations with third party retailers and a considerable degree of inter-personal trust. At a basic level, Retailer B developed some separate and distinct ranges as a wholesaler for third party retailers to reduce overlap with its core offer, though there remained significant products which both parties sold. On the one hand, this restricted the number of markdown and promotional price changes that Retailer B could make over the season given the transparency of price on its web site, but inevitably sometimes price reductions were deemed necessary. On occasion, Retailer B could implement 'hidden' price promotions through promotional email vouchers sent to loyal customers rather than explicitly stating such on their web site; nevertheless, managing the sensitive wholesale relationship with third party retail partners also selling their product required careful management.

While the pro-active management of inter-firm relations was evident, there were also examples of online fashion retailers dealing with a retail partner less committed to an ongoing relationship and leveraging the online medium to discount the lead fashion retailer's merchandise beyond their direct control. These issues were taken seriously given the global visibility of such activity, which was likely to have negative implications for fashion retailer brand reputation and price positioning. On such occasions, Retailer B attempted to reign in this behaviour. As the Director of Wholesaling reflected:

> We supply Amazon with about [XX]% of the range in Womenswear as well as a lot of stockists who also trade on Marketplace. The pricing wars that then ensue are 'bonkers'! Our lack of control over that […] [We] only give them a small range, but [we are] keeping close to Amazon […] We are able to have candid conversations with them [as they] want more of the range (B1)

Engaging with the inter-firm network of suppliers took time and was viewed as a process of negotiation given the interdependencies between the retailer and the supplier. And, because of the need to negotiate regarding sensitive topics such as financial contributions from a supplier for price reductions or the implications of price changes on merchandise already purchased by a wholesale retail partner, the issue commonly required meetings in person, usually within head office with the supplier or retail wholesale partner, rather than relying on virtual communication:

> As part of our agreement we invite [the retail partner] to join us [in the price reduction/promotion] and assist in the pain that will be their loss of profit [...] Sometimes it becomes a localised conversation with buyers within [the retail partner] where they might take the decision to join to enhance sales [...] [We] deal with 13 different buyers within [the retail partner] so it can be quite tricky (B1)

This need to meet in person the discuss reduced the speed with which changes could be made but was seen as unavoidable in order to maintain relations between the parties. As such, *inter-firm digital interdependency management* emerges because of the specific effects of digital business models on relationships with suppliers and new forms of interdependency and associated negotiation. This has spatial implications because of the meetings needed to negotiate new challenges such as those associated with pricing.

5.2 Intra-firm digital interpretation and decision-making 'business code/spaces'

Sourcing in digital retail business models, including for a 'test and repeat' approach described earlier, managing price adjustments and dynamic virtual stores all demand the active engagement of particular intra-firm work communities. For example, across all five fashion retailers there were distinct communities which physically came together to finalise the products across a range and agree the associated pricing architecture. Here it was explicitly recognised that there were limitations to analytics and expert systems, with competing views and opinions contributing important tacit knowledge that was deemed essential. The actors involved included buyers who were responsible for sourcing the product and the 'buy in margin' (BIM), merchandisers who were responsible for then managing the price and sales volume, as well as senior managers (including CEOs in some instances) who had the responsibility for final approval.

While there is evidence of dysfunctional relationships between buyers and merchandisers within the marketing literature (e.g. Watson et al., 2015), we found there was recognition by executives of a need for co-operation and physical proximity to link sourcing, price setting and subsequent price management. As a Merchandiser for Childrenswear suggested:

> The buyer is my direct counterpart—they do the sourcing of the products and are very much the link between the supplier in the first instance and setting the cost prices and negotiating that side of things. We work together collaboratively in terms of I provide how much I think we're going to sell of it in the first instance so that they've got some quantities to negotiate on. We work hand-in-hand the whole way through the process (B3)

Rather than building a product range and its price architecture virtually, there was agreement across our retailers of the need for physical meetings to appraise the products, their quality, and the coherency of the range. It was recognised that the strength of the intra-firm community was more than the sum of its individual parts. As one senior buyer reflected:

> Everything that we do for our Department is agreed together. So, we'll sit and we'll write our strategy together, we'll write our selection packs together [...] I think probably the one thing that I could say in this business is, if the buyer and the merchandiser try to do it independently, it will fail (C30)

Indeed, ironically while there is the ability to instantaneously manipulate virtual store layouts, the process of decision-making regarding those ranges is partly informed by a mocked up 'show rooming' process. This consists of laying out the fashion ranges to permit 'walk-throughs', allowing executives to physically handle the products, to judge their quality against their suggested pricing and the way in which they fit in the context of the range. Interestingly, this process effectively emulated what a customer would see and experience in a conventional store, despite the fact that such physical arrangements have little relevance to neither how the customer shops in the non-haptic internet store nor how they judge their purchase on delivery. Nonetheless, it was argued that these tangible insights based on physical proximity with the merchandise and discussion between key actors provided a basis upon which they should make decisions:

> We're remote from our product because we don't have stores. I think, when you're a retail buyer in store world, you're touching, you're feeling – "My God, that's way better than £699…why am I giving it away at that?" (C32)

> … it comes down to when you physically see the product because it's hard [...] from the quotes we get, it's just literally a piece of paper with an image on, and technical information, so it's a bit hard to see it there. So, the most amount of work is done during "product day", when the product is physically there and you can see, "oh, this is worth £299 or £399" etc. (C11)

Executives acknowledged that the physical act of 'being there' permitted deep discussion and challenge regarding the ranging and pricing. The Director of Wholesale for Retailer B noted:

> There's a sign off sheet basically where you have to add commentary to say why you are under or over [on price/margin]. At that stage−basically because it is a month before "go live"−that's when the heads of buying and the heads of merch[andising] would get involved to say "all your trousers are 29 - there's no shape". In the sign off process itself, every garment has a ticket on it so [on] every garment the price is clearly visible (B1)

This process involves the actors challenging each other on the proposed product, range and price architecture:

> The buyer and myself and the team, we will go through, in our product day, each price point, and each cost price and selling price, and that's where we'll challenge each other. Me and the Buyer specifically will challenge each other to say "Do we really want to go at that or do we want to go higher or do we want to go lower?" and that kind of thing (C33)

Given that the process is not governed by tangible rules or data given it is *ex ante* of actual sales, differential power relations and emotion sometimes come to the fore. As a Head of Buying of Retailer B candidly opined, one of the senior managers had the effect of dominating some of their peers:

> The most senior person on their team is Head of Design and she's quite a strong character so that rules a lot of the roost there, but she's pragmatic as well and she talks a lot about price and is conscious of it, but I don't think the Buying and Merch team maybe have as loud a voice [as they should] (B6)

While conflict and challenge were deemed an essential part of the decision-making process at the range and price sign off meetings, sometimes there were some concerns of senior management having an excessive influence, as one Senior Merchandiser attested:

> I think we need more courage for that if we can back up low prices with good sales we should be fighting to keep them and I think there's a bit of a tendency to just go with whatever they're being told to go with. I think the buyers are in a senior role and should be able to have the courage of their convictions and say no when that's right [...] it's a bit knee jerk for whatever the strategy of the day is (C1)

In terms of pricing adaptations, there was an inherent challenge with highly responsive software that would commission price responses at a speed and level far in excess of that practically reasonable that also ended up grounding decision-making within intra-firm communities. As one senior buyer acknowledged:

> [Competitor A] change their price four times a day. So, [Competitor B] will follow [Competitor A], and then [Competitor C] will follow [Competitor B], so it's kind of a spiral [...] so there's constant price changes during a day. I can't do constant price changes (C12)

Such issues were more than simply placing an excessive demand on an individual analyst—at their most extreme, such was the speed and degree of automation in the interpretation of these data, that price changes would be commissioned that would lead to a spiral of automated defensive responses which, if left unchecked by human intervention, would damage the profit and pricing architecture of the retailer. These hyper-responsive virtual systems have numerous parallels with recent economic geography research on high frequency trading that is characterised by 'specialized computer software' that pursues 'strategies at speeds beyond the capabilities of human beings' and which necessitate little-to-no human insight' (Zook, 2018: 578). The issue with retail pricing virtual systems was that human intervention *was* required to prevent hyper-reactive responses to observed competitor pricing fluctuations. Retailer C's Head of Merchandising for Footwear suggested:

> We benchmark more than one retailer and, all of a sudden, we find ourselves "We're up, we're up, we're down, we're down" and kind of it looks like we're just way out [...] we're out of sync with the market. More often than not, it just seems to come back to force us into making tactical changes to our pricing that meets a very short-term kind of [insight] piece that, in the end, undermines your architecture to the point where, over time, it disappears (C16)

The nature of the decision-making processes was often complex and slow, which contrasted with the potentially highly responsive data rich environment. One extreme example in Retailer C provided detail of intra-firm bureaucratic decision-making structures, with (re)-pricing approvals being passed remotely (and slowly) between departments in the absence of someone 'owning' the issue and physically walking around the head office in order to gain agreement:

[A price change] comes through to me to approve, and then, once I approve, it goes to "the head of" to approve, and once they approve it, it goes to Pricing Ops to approve, and then it gets actioned, which sometimes that can take a couple of days [...] That [then] influences the cost price, at that point then, the Buying Assistant would have to raise a new form to change the selling price [...] That then goes to Pricing Ops for them to action. So, again, that can take a couple of days (C10)

These examples – while underlining the potential of leveraging real time data-driven insights – also highlight the enduring role of human judgement, interaction and consensus in managing knowledge within intra-firm work communities. The result is *intra-firm digital interpretation and decision-making* practices that are crucial to the realisation of digital business models. Decision-making typically occurs within head office based intra-firm work communities that are necessary for digital retailers if they are to operationalize approaches of constant price comparison and adaptation, the instantaneous manipulation of virtual store layouts, and a shift towards 'test and repeat' sourcing models.

6. Conclusion: Towards a Conceptualisation of the 'Business Code/Spaces' of Digital Service Firms

In this paper we have examined the mutual constitution of digital infrastructure, software and the spatiality of economic life (Kitchin and Dodge, 2011). By focusing on online fashion retail we have addressed the paper's theoretical question – *how do digital business models affect the 'business spaces' of service firms?* – through an approach consistent with Zook et al. (2004:158) who seek to understand 'how digital communication technologies actually do their "work" at the level of individual, everyday performances of space'. Specifically, the paper prioritises the way digital infrastructures and software help constitute the business practices that ultimately produce organisational spatiality (Faulconbridge, 2012; Jones and Murphy, 2011; Vallance, 2011; Yeung, 2005). The paper identified *inter-firm digital interdependency management;* and *intra-firm digital interpretation and decision-making* as distinctive mechanisms associated with firms adopting digital business models. Here we consider how these mechanisms constitute 'business code/spaces'– i.e., the way entanglements between virtual, information-rich and potentially responsive networked infrastructures, and materially and socially situated infrastructures of firms produces local- global geographies.

In Table 2 we conceptualise the different intersections between digital infrastructure and software and the wider material, social and organizational features of online fashion retail firms that generate practices of *inter-firm digital interdependency management;* and *intra-firm digital interpretation and decision- making*. We identify five factors generating such business practices in online fashion retailers. First, the materiality of merchandise that relies on the haptic appraisal by internal firm actors in the fashion ranging decision-making process. Second, the social requirement for collaboration within and beyond the firm's boundaries (often based on face-to-face meetings) to overcome the disruptive effects of digital price visibility. Third, the scope for infrastructural adjustment to exploit fully the potential offered by digital

business models that has significant implications relating to head office development and sourcing networks. Fourth, the exploitation of digital analytics that permit instantaneous changes to the web store. Fifth, the requirement for manual interventions from a central head office node to mitigate against unbridled virtual effects. We highlight how each of these five factors produces particular business practices with particular spatialities associated within inter- and inter-firm relational networks. We extend the ideas of Jones's (2009) by examining the way digital business models constitute 'business spaces' and the practices of management within firms. We go beyond considering how the digital serves existing practices and identify the new practices that arise as a result of reconfigurations driven by big data, automation and related digital technologies. We also extend the work of Kitchin and Dodge's (2011) by considering how the 'code/spaces' they outline manifest themselves in service firms. Specifically, we conceptualise the intersection between the digital, the socio-economic and the spatial (Ash et al., 2018; Foster and Graham, 2017) as resulting in particular practices of interaction and socio-spatial interdependency that define the 'business code/spaces' of digital service firms.

[Table-2]

Our analysis of 'business code/spaces' shows that in existing work on the geographies of service firms the focus on clients/customers (Faulconbridge et al., 2011; Jones and Search, 2009), collaborators/suppliers (Sassen, 2012), team members (Grabher, 2004; Jones, 2007) and institutional contexts (Goerzen et al., 2013) remains important. However, the mechanisms constituting and giving character to these relations changes as digital infrastructures and software create new interdependencies. As such, the digital business models of service firms render inseparable the 'four spatial 'fields' – material, social, organizational and virtual' that Jones (2009:204) highlights, with the digital being constitutive of as well as constituted by the other three, as exemplified by Table 2 for the case of online fashion retailers. The 'business code/spaces' concept thus advances economic geography debates about the role of digital technologies in internationalizing business service firms and the way they facilitate the spatial stretching of existing processes of management control (Jones, 2007), learning (Faulconbridge, 2006, 2017) and teamwork (Grabher and Ibert, 2014). Specifically, the 'business code/spaces' concept proposes that new forms of socio-spatial relation are constituted by digital infrastructures and software (see Table 2), with digital infrastructure and software not simply used to attend to already existing socio-spatial relations. Hence the 'business code/spaces' concept explains the importance of co-presence, proximity and thus the continuation, in rearticulated forms, of spatial fixes through analysis of the constitutive role of digital infrastructures and software. This is an important redirection of analyses given the penetration of the digital into virtually all sectors of the economy. We also show that focussing on business practices provides the most productive way to understand 'business code/spaces' given the need to examine the forms of interdependency that exist between different actors and the responses to this which are generative of socio-spatial relations and organisational spatiality.

Our analysis also makes important empirical contributions to the literature on the effects of digital technology and networked data on the economic geography of retail. Our analysis addresses the empirical question: *How does the digital nature of online fashion retailing affect 'business spaces'?* and reveals three distinctive features of the 'business code/spaces' of online fashion retailers. First, the potential opportunities offered through real time analytics, digital networks and 'big data' are shown to be considerable for empowering firms to make rapid and informed decisions remotely, significantly amending traditional business models and linking businesses and consumers in new ways (Moriset, 2018). For example, we observe benefits associated with the automated tracking of competitor pricing to inform timely price adjustments, the tailored manipulation of the customer's virtual shopping trip, as well the potential for more extensive and appropriately tailored fashion ranges informed by demand analytics and supplied by locally responsive sourcing networks. Furthermore, the influential and powerful role of social media allowed our online fashion retailers to invest in modestly sized international head offices at most given that much of their marketing was virtual in nature. Yet, our focus on 'business code/spaces' reveals that the practical realisation of many of these efficiencies are compromised by the inherent risks of automated processes occurring unchecked by human judgement, the negative implications of online visibility for collaboration with inter-firm actors (e.g. wholesale relationships with third party retailers) and the physical restrictions of retail logistics and distribution in relation to volatile physical flows of merchandise. The corollary is that many decisions remain necessarily projected through the local lens of interpersonal decision-making within work communities and the wider cognitive frame of the organisation itself. In this manner, despite the potential efficiencies offered by online business models and big data analytics, and the evolving business practices outlined Table 2, many of the conceptual challenges remain familiar to retailers from the store -based era. Intelligent reflection, using the benefit of experience and reliant on the movement (and availability) of physical product in the right place at the right time, remains paramount.

Relatedly, working remotely and solely based on analytics is currently unrealistic. It was within these contexts that respondents discussed many of issues familiar within the economic geography literature concerning decision-making in relation to 'business spaces'. These included the need to ground final decisions in 'range and pricing' decision meetings where all actors within the relevant work community could be physically present, garments appraised and product ranges assessed as a collective whole. As such, there were limitations in the ability of digital technologies to facilitate relational proximity without spatial proximity (*cf.* Amin and Roberts, 2008; Bathelt and Turi, 2011). It was the act of 'being there' that allowed confrontation and challenge that would likely be troublesome to achieve remotely given the sensitivity of the topics and the broad range of actors participating. Perhaps inevitably, this introduced aspects of differential power relations; with senior managers affecting more junior actors to the latter's frustration (*cf.* Strauss, 2009). Actors' 'relative relational positioning' within organisational internal structures sometimes affected the outcomes of these important meetings which lends further support to the assertion that power cannot be separated from the spatial and temporal

dimensions of actual workplace contexts (Weller, 2009). In other instances, there was a perceived need for physical temporary co-location for both merchandisers and buyers to permit co-operation on buying trips for example even though technological communication might seemingly have sufficed (*cf.* Faulconbridge et al., 2009; Jones, 2009).

Second, at the spatial scale of the retail firm, there remain numerous conflicts between the traditional pre-digital and digital virtual business models which continue to play out. While internet-based 'data scraping' of competitor web sites provide evidence of price misalignment and seemingly permit instantaneous changes to 'go live', these are often not possible due to restrictions that are embedded within both the geography of the physical distribution/logistics systems and intra-firm ossified hierarchical decision-making structures. As Foster and Graham (2017) suggest, data networks represent a form of partial knowledge that lacks understanding of the implications of actions. On the one hand, the potential inherent with instantaneous online price changes are rarely achieved due to the complex and bureaucratic decision-making processes that require multiple approval by numerous actors across different hierarchies of the retail organisation. On the other, there is recognition that the implications of price changes lead to challenges upstream in the distribution network, at retailer and third party owned warehouses that, if not handled with care, might compromise inter-firm relationships with valued partners.

Third, it is evident that while virtual networks and analytics offer considerable opportunities for information exchange and (virtual) access to new customers across new geographies, this also exposes lead retail firms to some lack of control over their business models. While aspects of disintermediation within online retailing are well known (Crewe, 2017), we found that the arm's length wholesale relationships with some retail partners which operate parts of their business online (e.g. third party sellers via Amazon) saw them come into direct price competition with the lead retailer's own website. In the past, such price competition would have been obscured across geographically dispersed store networks leading to a degree of information asymmetry to the disadvantage of the consumer. In the contemporary market, such inconsistencies are an immediate source of concern and lead the retailer to attempt to re- exert their power through veiled threats implying removal of future business. This is possible because, despite the internet democratising price knowledge, power continues to reside in the lead retail firm given its size and design/brand advantage (*cf.* Parker et al., 2014). More widely, while inter-firm wholesale relationships are profitable, the fact that they share common merchandise that is highly visible on online platforms means that the ability to independently flex price and promotions is compromised, at least without divisive implications for the health of ongoing inter-firm relations. Again, this limits the lead retail firm's ability to adjust their pricing and ranging at the speed of the data and analytics.

In sum, our analysis of the 'business code/spaces' of online fashion retailers provides notable insights into how digital infrastructures and software generate a situation in which economic activity becomes, yet again, theoretically footloose but paradoxically remains, to some extent, spatially fixed. The 'business code/spaces' concepts helps us understand the latest defiance of 'end of geography' (O'Brien,

1992) and 'death of distance' (Cairncross, 1997) hypotheses, and sets the agenda for work that takes seriously the way digital infrastructures and software become constitutive of business practices and spaces. We are only two decades into the revolution that online technology has brought, and it is likely that machine learning will deliver advances that will further transform the requirement for human interaction in decision processes. There are also further digital effects we have not discussed here, in retail examples including social media and digital influencers that affect product demand, and digital payment providers that intermediate between buyers and sellers. This highlights additional forms of inter-firm interdependency that further blur the boundaries of fashion retail firms as digital business models transform practices. Extending research to encompass a wider range of interdependencies, within and beyond the boundaries of the firm, would therefore be useful in advancing understanding of 'business code/spaces'. We postulate that future changes will likely result in further mediation between the material, social, organisational and virtual in ways that are generative of 'business code/spaces' that demonstrate continuity as well as change. The 'business code/spaces' concept developed by this paper will help us to understand and analyse these changes.

Table 1: Key characteristics of the case study international online fashion retailers

Retailer Retail sector	Retail presence	Fascia	Sales	Wholesale sales *e.g. through department stores or other online retailers*	Online sales (as % of total) [est.]	International head offices and physical retailer staff presence	International distribution center/warehouse presence and fulfilment
A Fast fashion -*teenagers, 20-something focus*	Online, through third parties	Multi-fascia	> £300m	No	circa 100% of retail sales	Small head office in the United States – which acts more as a local marketing function	No – international fulfilment from home market. US fulfilment facility opened in 2018
B Fashion - *middle age focus*	Online, physical stores, wholesale	Single fascia	> £100m	Yes – domestic and international	circa 35% of retail sales	No staff presence overseas. Wholesaler relationships and 3rd party agents	No – international fulfilment from home market
C Fashion oriented department store - *all age groups*	Online only	Multi-fascia	> £1.5 billion	No	circa 100% of retail sales	Small Irish head office – but balance of decision-making remains in the UK	No – international fulfilment from home market
D Formal fashion retailer - *menswear*	Predominantly mail order and online. A modest physical store portfolio in high profile locations	Single fascia	> £200m	No	circa 70% of retail sales	Small head office in the United States – but balance of decision-making remains in the UK	1 (US– but only fulfils US store sales [not US online]. All other international sales fulfilled from UK)
E Lifestyle fashion orientation - *20-something – middle age focus*	Online, physical stores, wholesale, concessions	Single fascia	> £700m	Yes – domestic and international	circa 25% of retail sales	Head office in each market where there is a store presence but centrally determined price and product ranging	3 (Continental European country, Hong Kong and United States)

Table 2: Digital effects on business practices that generate 'business code/spaces' in online fashion retailing

	Spatiality of decision-making	Modes of virtual/physical interaction	Example(s)	Network and Actors
Intra-firm digital interdependency management 'business code/spaces'	Retailer head office	**Materiality** of merchandise *The continuing role of product in virtual space*	Sign off meetings on fashion ranges leads to the physical presentation of a 'mock up shop' in order for senior management, buyers and merchandisers to interrogate range and pricing architecture and agree final decisions	Intra-firm network Senior Management, Buyers, Merchandisers
	Retailer head office but played out online	**Exploitation of digital analytics** to the webstore experience *Using data driven instantaneous insights to produce a responsive virtual web store*	Data informed and responsive price changes Amendment of the web store customer journey through changes in the (virtual) location of merchandise and increasing personalisation of the online store experience for consumers	Intra-firm network Merchandisers, Web Developers
	Retailer head office	**Intervention** to mitigate unbridled virtual effects *Rationalising the potential negative effects of automated changes derived from data analytics*	Manual over-ride of automated price changes - a break on the automation of the retailer's changes in response to price changes at competitors by maintaining pricing and range architecture	Intra-firm networks Merchandisers and Buyers
Inter-firm digital interdependency management 'business code/spaces'	Retailer and third party retailer head offices Phone and video conferences	**Collaboration** to overcome digital effects *Working with third parties to mitigate disruptions brought about by virtual effects*	Retailers work with buyers at third party wholesale partners (e.g. department stores) to share the cost of price reductions now necessary due to highly visible price discounting elsewhere	Inter- and Intra- firm networks Buyers from lead retailer and third party retailer wholesale partner
	Third party suppliers in Midlands (UK) garment district, retailer head office and warehouse ----- Small city-based subsidiary head offices	**Infrastructural adjustment** to exploit digital advantage *Amending physical infrastructure in the light of digital networks*	Re-shoring of sourcing networks to the UK, ordering wide and shallow allows the retailer to exploit the responsiveness of data analytics on consumer demand and then re-ordering promising merchandise lines for rapid delivery ----- 'Skeleton' (rather than fully functioning) subsidiary head offices overseas (focused on leveraging brand with fashion social media). Control remains predominantly from the home market	Inter-firm networks Buyers and merchandisers with third party manufacturers ----- Inter- and Intra- firm networks Marketing and PR specialists with the fashion media

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