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Knowledge, expertise, craft, and practice: becoming and being a cycle technician

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ABSTRACT

This paper provides an account of the everyday workplace learning of cycle technicians. Derived from an ethnography of working cultures and practices at a bike shop in the North of England, this paper rests on a critical reading of Communities of Practice theory in order to explore the complex and heterogeneous learning of cycle technicians. Drawing on a series of vignettes constructed from the ethnographic data, the paper demonstrates the variety of experiences of both formal and informal learning that characterise the trajectories of new cycle technicians as they enter the industry. In addition to providing an account of a qualified and specialist workforce that is under-represented in extant research literature, the paper also provides an exemplar for ethnographic research as a vehicle for exploring working practices through a Communities of Practice lens, using the paradigmatic theoretical elements of the theory. The paper concludes by arguing that for cycle technicians, and perhaps other occupations as well, Communities of Practice theory can generate rich and complex accounts that do justice to the richness and complexity of the craft and practice being observed.

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Introduction

In 2020, the UK cycling industry was worth £2.3 bn., boosted by the take-up of cycling during periods of pandemic lockdown and a concurrent rise in sales of electric bikes (e-bikes) in particular. It is an industry that supports over 64,000 jobs, and there are over 2,700 cycle shops in the UK. [1] As an object for academic inquiry, cycling has been explored in terms of history, habits and technologies. Prior studies have ranged from sociological and cultural inquiry to historically-situated sociotechnological critique (Bijker, 1995; Horton et al., 2007), and from social history to ways of knowing in craftwork contexts(Martin, 2016; Oosterhuis, 2016). But what about the technicians and retailers who get the bicycles onto the roads in the first place, who assemble them so that they are roadworthy, who service gears and

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brakes and who replace broken spokes? Patterns of both formal and informal learning within occupations/professions such as motor vehicle, engineering, or avionics – areas of work that of necessity require theoretical, technical, and practical or 'hands-on' ways of knowing – constitute a well-established body of research (Barber, 2003; Brockmann and Laurie, 2016; Brodie, 2001). What can an analogous study of the formal and informal learning of cycle mechanics offer?

My initial interest in researching the formal and informal learning of cycle mechanics was centred on the *Cytech* (Cycle Technician) qualifications scheme.[2] Cytech was launched thirty years ago by the Association of Cycle Traders (ACT), the largest cycle trade body in the UK, and in its current form consists of an initial theory module followed by three technical components of increasing complexity, with level two positioned as the industry standard for professional cycle technicians.[3] Akin to National Vocational Qualifications (NVQ) in the UK, these were designed as competence-based programmes for people already working or apprenticed in the trade, although in recent years a small number of training providers have started to offer standalone Cytech courses for people wanting to enter the industry and are now offered by several private training providers (the largest of which is part of a consortium alongside several formerly free-standing further education colleges and other training providers[4]). Longer-standing City and Guilds qualifications continue to be available in a small number of locations, but Cytech has become the most widely-recognised qualification and there are currently 470 businesses registered as members of the ACT who employ at least one Cytech mechanic trained qualified to at least 'technical two' level.[5]

My interest lay in the validity and reliability of the Cytech assessment. However, this topic was quickly absorbed into a broader project, informed by my wider ethnographic and theoretical work concerning social practice theories of learning and literacy, and socio-material frameworks for ethnographic research (Tummons, 2021). Reframing and expanding my research as ethnography, I constructed three inter-related research questions (the traces of my initial research interest can be seen at work in the first and third of these):

(1) Becoming a bike shop worker: how do people learn how to become cycle technicians?
(2) Tools, paperwork, and workarounds: what are the cultures, and materialities of the workshop?
(3) From local to global: what can the workshop tell us about technical and vocational education and training?

Here, I offer initial responses to the first question through an interim analysis of the data gathered during the first five months of the project, arranged around a series of vignettes. This is followed by an analysis of the vignettes that draws

on several key elements of Communities of Practice (CoP) theory, which are outlined in turn.

Methodological, ethical, and theoretical matters

The data on which this discussion rests comes from an ethnography that, at the time of writing, is at the half-way stage (Atkinson, 2017; Banks, 2007; Spradley, 1980). For five months, I have been observing the everyday work of the staff at *The Bike Shop*[6] (described below), going to the shop two or three times each week, on different days (including Saturdays) and at different times (when opening, during the middle of the day, at closing time), moving between the workshop and retail areas of the building, writing field notes and taking photographs, and collecting and/or photographing and/or perusing text-based documents, depending on size and format. Each visit lasts approximately three hours. I transcribe my field notes as soon as practicable after each observation. At the time of writing, the data set consists of transcribed notes from observations [n = 38; approximately 135 hours], photographs of tools, components, equipment, shop fixtures, signage and paperwork [n = 223], and documents, including worksheets, webpages, and technical manuals [n = 24]. All of the data is managed and coded using Atlas-Ti (Friese, 2014; Tummons, 2014). The fieldwork is anticipated to last for a further five months. Obtaining informed consent to carry out the research involved a lengthy process of negotiation that lasted six months in total and culminated in a meeting with the two directors and all eighteen of the employees at which I outlined my research interests and answered their questions. I received institutional approval from my university in December 2021.

The practices of becoming and then being a technician and/or retailer in The Bike Shop are multifaceted. They involve, amongst other things, learning the routines, systems and habits of the workshop and/or retail spaces; learning how to be a cycle technician and/or learning new practices in response to technical innovations, new products, and so forth; and using specialist tools and discourses. Further reflecting the inter-related nature of my research questions, I have framed these within a critical reading of *Communities of Practice* theory (Lave and Wenger, 1991; Wenger, 1998).

Communities of Practice (CoP) theory has, akin to other theoretical and conceptual lenses, been used critically and insightfully as well as poorly (Lang and Canning, 2010; Tight, 2015; Tummons, 2022). Relevant critical applications of CoP theory have included studies of nursing students (Mayne et al., 2015), hairdressing apprentices (Billett, 2007), literacy tutors working with apprentices (Sligo et al., 2019), modern apprentices in the UK steel industry (Fuller et al., 2005), assessment within different parts of the vocational curriculum (Torrance et al., 2005), and teachers of floor and wall tiling (Boud and Middleton, 2003). Studies such as these as well as others (Barton and Tusting, 2005; Hughes et al.,

2007) demonstrate the ways in which CoP theory can generate rich descriptions of learning within specific bounded contexts defined in terms of occupational and/or institutional context, whilst also at the same time noting those issues that are problematic within or simply absent from CoP theory.

In thinking about The Bike Shop as a Community of Practice (CoP) it becomes possible to explore the ways in which people learn how to become a technician, including not only more recognisable practices such as the correct procedural use of specialist workshop equipment but also more idiosyncratic practices that are part of the repertoire of The Bike Shop specifically rather than the cycle industry more generally. The paradigmatic elements of CoP theory (I discuss these below) provide conceptual tools for an ethnography of a specific site of work that encompasses people, routines, artefacts, discourses, and so forth (Wenger, 1998).

Welcome to The Bike Shop!

The Bike Shop is a large independent retailer based in the North of England. It operates three different retail sites, and the largest of these is the focus for the ethnography. It was established thirty years ago and is run by two directors (one of whom founded the business as a sole trader). They employ eighteen members of staff, some full-time and some part-time. The Bike Shop sells a range of cycles – town bikes, sports bikes, e-bikes and folding bikes – and also offers servicing and repairs. Some staff left school aged 16, others after A levels, and some have university degrees in subjects ranging from fine art to engineering. The majority are designated as technicians (the focus of this discussion) and others as retail staff – these are seen as primary roles for the purposes of designing work rotas, but in fact the majority of the retail staff are also capable of doing some of the workshop tasks, and the workshop staff in turn help with customer enquiries either in person or by telephone. The majority of staff hold Cytech qualifications.

Vignette one: an experienced and qualified cycle technician. 26 January and 5 April 2022

(1) January 2022. Alex has worked at The Bike Shop for almost twenty years. After GCSEs, he attended 6th form college to study for A levels, but "hated it and so I left." When he was first employed by The Bike Shop he already "knew bikes" – when growing up, one of his best friends was the son of one of the directors of another cycle shop in the same city (established approximately fifteen years before The Bike Shop) and spent lots of time "fettling up and messing around" with bikes of all sorts. He now holds the highest – 'technical three' – level Cytech qualification. Three members of staff were working towards the

technical three qualification at the same time and the Cytech assessor came to The Bike Shop for a day to sign them all off. Technical three requires the candidate to focus on a number of specialist areas that can be chosen from a list of options, but Alex wanted to focus on Brompton folding bikes – and the assessor agreed to this negotiated component "even though I knew more about it than the Cytech guy. He'd never done that job." So what is the role of the assessor here? For Alex, it's "an overall judgement that shows that you know what you are doing, even if you make a mistake. The mistake wouldn't fail you if your overall conduct was okay."

(2) April 2022. Although qualified to technical three, Alex spends more of his time in retail than in the workshop. Today, he is preparing for a customer who has ordered a Cannondale electric road bike – she is due to arrive later in the day. Peter (one of the two directors, who invested in The Bike Shop and began working here fifteen years ago) asks Alex if he knows his way around SmartSense – the proprietary lighting and mapping system that users can manage through an app on their mobile phones.[7] "Not really" Alex replies, leading Peter to recommend that he logs onto *Cycling Prophet*.[8] Cycling Prophet is an online training tool to allow bike shop staff to update their knowledges about the products they sell. Information is presented in the form of short videos which are followed up with an online multiple-choice quiz – a ubiquitous format for online training. "I'm not watching this!" Alex says, and instead goes straight to the quiz, achieving a perfect score. Finally, he checks out the app: "the customer can download this herself and I'll go through it with her on her phone".

Alex's trajectory is similar to those of the majority of staff at The Bike Shop: a childhood and/or adult interest in mending as well as riding bikes leading to the acquisition in an informal and unregulated manner of a range of mechanical competences and bodies of knowing that when combined act as one of the 'entry criteria' for employment at The Bike Shop. When taking on new technicians, the directors will ask candidates to spend a day in the workshop, working on a stock bike that has been deliberately incorrectly set-up, and the mechanics will discretely observe how the candidates solve the problems that have been generated for them, and report back. Successful candidates who do not already hold Cytech qualifications will then be encouraged to do so: The Bike Shop will pay for any required training as well as assessment, but if the mechanic leaves within one year then they would have to pay it back. Formal accreditation is valued and seen as important at The Bike Shop, but is not seen as the only measure of a technician's expertise: lived and embodied expertise and experience, as evaluated within the CoP on an everyday basis, is also recognised.

Vignette two: learning from others in the workplace. 26 February and 25 May 2022

(1) February 2022. Mark is one of the newer technicians, having started at The Bike Shop a little over a year ago. He has a lot of experience, does not hold any Cytech qualifications, and is training Lawrence, a newly-appointed part-time member of staff, in 'building' bikes. When any bike arrives from the factory, it requires assembly, and the extent of the work required varies from manufacturer to manufacturer. At The Bike Shop, technicians work to a *Universal Buildsheet* of their own design, that has evolved over time, and provides a checklist of the tasks required, ranging from correct derailleur shifting and balanced brakes to secured mudguards and correctly inflated tyres. One technician will build the bike before it goes on display for test-riding, and then a second technician will double check all of the items before countersigning the Buildsheet. Lawrence is building a Gazelle e-bike, working through the Buildsheet, item by item, with Mark checking things over in between his own repair work. But he is unfamiliar with the Woods/Dunlop valves that Gazelle use on their bike wheels and inadvertently deflates the rear tyre completely. Mark explains how these "old-fashioned – only Gazelle use these" valves work and reminds Lawrence that recommended inflation pressure is always embossed on the sidewall of any tyre.

(2) May 2022. There are two secondary-school age (fifteen years old) students doing work experience at The Bike Shop. One of them, Ben, is in the workshop with Lloyd, the workshop manager. Lloyd left school aged sixteen and went straight into the cycle trade, completing an apprenticeship and then the full Cytech programme at the same shop where he had done his own work experience a year earlier. He moved to The Bike Shop six years ago. Having done work experience himself, Lloyd is keen to make the experience worthwhile for Ben, rather than leaving him to simply 'sweep and tidy up' or 'make the tea'. As I take up my usual place to observe the workshop, Lloyd and Ben are fitting lights to a new bike. But Ben is worried about breaking something.

Lloyd: "I break things all of the time! There's only one way to learn, isn't there?"

Ben: "does the [front] light go on any particular side?"

Lloyd: "what side do you think it should go on?"

Ben explains his thinking to Lloyd who nods encouragingly, in agreement, and then they turn to the rear light. Ben wonders if they should simply remove the rear reflector and put the light in its place. But Lloyd

points out that they can use a special part to fix the rear light to the carrier rack. This takes more time and effort but is a 'better' option:

Lloyd: "we're professionals, so we have to do a professional job."

Finding the time to train up newcomers to the community requires effort and planning. Irrespective of the nature of the newcomer (here, a new part-time member of staff and a school student on work experience), what might be termed the curriculum of The Bike Shop begins at the same point: unboxing a recently-delivered bike and building it for display and/or test-riding. The job of the more experienced and/or qualified technician (Lloyd is Cytech qualified, Mark is not, but this is immaterial to the training task) is to oversee the work of the newcomer, guide them through the required tasks in setting up the bike (here, fitting lights, correctly inflating the tyres and so forth), and show them how to complete the accompanying Buildsheet. Some of these tasks require learning how to use tools that might be found in all sorts of contexts – screwdrivers, pliers, or allen keys; others require specialist tools that are specific to cycle workshops – fourth-hand tools, pedal wrenches, or chain tools. Opportunities for learning are therefore generated not only through the explicit tasks, tools, and materials involved in building bikes, but also through the shared understanding of and commitment to the work being done, the capacity to help each other out, drawing on the technicians' competences and ways of knowing.

Vignette three: finding the answers on the internet. 26 February, 9 March and 11 March 2022

(1) February 2022. Mark, Lloyd and Joe (Joe has worked at The Bike Shop for ten years; left school aged sixteen to be a metal fabrication worker but always mended bikes as a hobby, qualified to Cytech technical Two level) are comparing seven- and eight-speed hub gear mechanisms. This discussion has been prompted by the most mundane of repairs – a rear wheel puncture done by Lloyd – that has nonetheless led to all sorts of problems in trying to get the gears to shift smoothly. The customer would not let Lloyd work on his bike again, so Joe has taken over: he has changed several components, but the results are not up to the standards that The Bike Shop technicians strive for. Part of the problem is that the eight-speed hub gear is less robust than the seven. Mark describes the customer as "not very mechanically sympathetic", as one of those customers (Lloyd and Joe nod in agreement) that could do with having a better sense of what their bikes can and cannot do, how they can and cannot work, and so forth. But then if every customer could just look up the answers "on Sheldon Brown[9]" then he – and the rest of the technicians –

would be out of a job! Sheldon Brown was a cycle technician, retailer and writer. Until his death in 2008 he maintained a comprehensive website, which is still online although no longer updated, of technical information for all kinds of cycles. For Mark, Sheldon Brown's website is "the bible" for cycle technicians.

(2) March and 11 March 2022. Wednesday 9 March – Wednesdays tend to be quieter days in the workshop and Simon (twenty years at The Bike Shop, holds Cytech technical three, has a degree in environmental sciences) is using the time available to view a number of online resources in preparation for a pre-booked workshop job: replacing/repairing the drive unit of a Riese and Müller e-bike. He's not entirely sure how the damage was done, and the customer is being a little vague ("he swears he doesn't know. Either he tried to mend it himself or he got someone else to do something"). He's been watching a video[10] and viewing technical diagrams[11] but is in fact comfortable with how to set about the work: the online resources are as much about confirming what he already knows as they are about practising new skills or procedures. Two days later, the replacement Bosch motor unit arrives at the shop – Jane (retail, has worked at The Bike Shop for nearly twenty years) brings it through from the stockroom, along with the *Workshop Job Special Order* form. Simon unboxes the parts, taking them out one-at-a-time and turns them over, seeing how they slot together, looking at them from all angles. His curiosity and interest are infectious, and Joe and Rob (mechanic, Cytech Technical three qualified) both come to look.

Rob: so what's all this then?

Joe: are you going to do that today? I'd like to see that.

Simon: no. Not enough time. [But] I'm slightly excited about it!

Using the internet to look up how to do something or to answer a question is a practice so ubiquitous that it barely justifies comment. In a manner analogous to many other occupations, online resources have supplanted printed materials: *Sutherland's Handbook for Cycle Mechanics* (like a Sage Handbook, but for cycle technicians) was first published in 1975, whilst the seventh edition was published in 2004[12] – there has been no further update. Here, the interest lies in how people choose which websites to use and why, how website content is mediated or curated, and how people bring prior experience and/or meaning-making to their use of online resources (Lankshear and Knobel, 2011). The resources that Mark and Simon are using are not password protected, nor paywalled, nor open only to subscribers. They can be found by anyone through a simple internet search, but they are not intended to be accessible by everyone.

That is to say, they speak to an already-knowledgeable (to varying degrees) audience, rather than to the newcomer. The Sheldon Brown 'bible' works like a combination of an encyclopaedia and a technical reference manual. The longevity of the website, fifteen years after the death of the author, is testament to its value and utility. Meantime, the e-bike videos watched by Simon have been filmed and posted online by a trade retailer, not a hobbyist, and are self-evidently similarly intended for an experienced and already-knowledgeable user.

The Community of Practice

As a Community of Practice, The Bike Shop consists of a number of elements that work together to both establish and maintain the CoP, and within the CoP there are discernible patterns of learning: a CoP is, simply put, a descriptor for a particular socio-technical-spatial configuration within which learning, understood as a social practice (as distinct from an individualised psychological one), takes place (Lave and Wenger, 1991; Wenger, 1998). As well as having visible and tangible *boundaries*, a CoP is characterised by *joint enterprise*, *shared repertoire*, and *mutual engagement*. Through exploring the different *trajectories* of the members of the community using these paradigmatic elements, we can begin to answer the research question that I posed above.

Inbound trajectories

From the outset it is important to remember (although it is beyond the scope of the analysis that I present here simply for reasons of space) that boundary crossing is not restricted to community members: tourists or visitors, resources, materials and artefacts are all able to cross boundaries in the right circumstances, and elements of the work done within, and/or members of, this CoP can also travel outwards and visit other places (Wenger, 1998). No CoP is an island. It is the crossing over of the boundary by the newcomer in order to establish a trajectory of membership of the community that is of interest here. As an element of the CoP, this boundary is conspicuous and clearly marked – although this should not always be taken for granted as any CoP can be more or less *tightly* framed, when practice is focussed around a specific body of work, or *weakly* framed when practice is more varied and changeable (Boud and Middleton, 2003).

The Bike Shop occupies a distinct space; the people who work there wear branded shirts, *t*-shirts, and sometimes caps. It is a physical space marked out by the presence of equipment, tools, bikes, maps, accessories and so forth that all speak to the practice of the community. It is also a semiotic space marked out by a discourse that encapsulates the practice of the community, rich with specialist terminology: 'headset bearings', 'fourth hand tool', 'rear triangle', 'bottom

bracket'. It is not problematic to see where this CoP starts and stops. Taken together, the equipment, *t*-shirts, jargon and accessories all bring into being the *shared repertoire* of the community: all of the stuff that allows the practice of the community to happen. The practices of the community include building, repairing, and servicing bikes, and all that these entail: wheelbuilding, repairs, advising customers when a repair is practicable and when it represents a false economy, online diagnostics for e-bike motors, advising customers on the 'best fit' for new cycles, phoning manufacturers to complain when a specified component does not work well enough, and more. These actions, techniques, bodies of knowledge and skill all come together to form the *joint enterprise* of the community – the things that the community is 'about'. In order to make these practices happen, the technicians talk with each other, observe and learn from each other, watch videos, ask each other question and help each other when they get stuck, and so forth – all elements of the *mutual engagement* of the community. But how does someone cross over the border of the CoP in order to access this shared repertoire, commit to this joint enterprise, and enter into this mutual engagement?

Starting to become a cycle technician requires entry to the CoP along a specific *trajectory*. Lave and Wenger originally conceived of trajectories as being 'extremely diverse and [not] predictable' (Lave and Wenger, 1991: 19) but otherwise provided little detail. Subsequently, Wenger (1998: 154–155) identified specific kinds of trajectory: for the newcomer, it is the *inbound* trajectory that is of concern. The member will start at the periphery, but is committed/allowed/expected to continue practising/learning in order to move to a fuller position, with a consequent greater depth of participation (Tummons, 2022). Initial access to such a trajectory within any CoP always requires the assent of community gatekeepers – in this case, these are the directors of The Bike Shop who decide whom to employ in consultation with the longer-serving technicians. Some level of practical skill as well as understanding and knowledge of mending and servicing cycles is therefore a prerequisite for membership. But this can be engendered in different ways. A straightforward way in can be effected through possession of Cytech qualifications, usually – but not always – acquired through prior employment. The fact of having previously been employed in a cycle shop provides a nebulous form of objectivised expertise, whereas the industry standard Cytech qualifications are an example of a *reified form* (Wenger, 1998): a physical – in this case, textual – artefact that encapsulates a body of knowledge and expertise.

Where does this skill and understanding come from? Oftentimes, it derives from a passion for the practices at hand – an enjoyment of cycling and by extension of mending and upgrading bikes that leads to qualifications and employment. But this is not a linear process in the manner imagined by policy makers concerned with routes to vocational employment for young people in formal education and training. Some, such as Lloyd (vignette two), do in fact

embody this formalised route of leaving school to do an apprenticeship and then working towards relevant occupational qualifications. More common are the paths followed by Alex (vignette one), and Mark and Joe (vignette three), who developed their understanding and expertise in an entirely unregulated way – as private passions – with any formal accreditation coming only after gaining entry into the community (and in Mark's case, this is an accreditation that still lies in the future).

For some, therefore, entry into this CoP – The Bike Shop – is predicated on having previously been a member of different CoPs, some tightly framed (a different bike shop, a cohort of trainees following a specific technical curriculum) and others loosely framed (a local cyclists' club, a group of hobbyists meeting together). Indeed, it is the latter trajectory that is more common. Of the technicians who appear in the three vignettes, only one (Lloyd) has established himself as a cycle technician through a formal accredited route after leaving school when aged sixteen. Of the others , two left school after GCSE or O level examinations aged sixteen (Alex and Joe) whilst the others have university degrees (Mark – photography; Lawrence – politics; Simon – environmental science) – but all came to become cycle technicians in part because for all of them, cycling, including repairing and servicing their bikes, was a hobby.

Insider trajectories

It is not sufficient for any member of a community to be able to cross the boundary as a newcomer. The practice of any community requires newcomers to continue to learn, a necessity driven by the ongoing evolution of the community. No CoP stands still, and at The Bike Shop – as at other similar CoPs – new learning is driven by external factors such as technological development (for example, the need to be able to build and service a new brand of e-bike) as well as internal factors such as the expansion of the business (such as increased workshop capacity requiring technicians to take on more complex tasks such as wheel building). Once established, therefore, technicians follow *insider* trajectories (Wenger, 1998) – trajectories that help us to think about what happens to a CoP member as they travel towards a fuller state of membership. But it is important to note that inbound and insider trajectories are not homogenous. That is to say, for some members of a community, the extent of their inbound trajectory – the depth of their engagement – is not the same as for others. Either through circumstance or choice, or through the actions of others (Tusting, 2005), participation might be restricted. For example, some technicians might develop an *identity* as expert wheel builders (Lloyd and Simon occupy this role), and others an expertise in e-bike servicing (a role normally taken at The Bike Shop by the more experienced, longer-serving, members of staff): the development of identity is a paradigmatic aspect of any individual's membership of a community of practice (Wenger, 1998: 191 ff.). It is beyond the scope of this

analysis to explore these different trajectories in depth – it is the fact of their heterogeneity that is salient.

In both following an inbound trajectory and subsequently an insider trajectory, any one of the technicians at The Bike Shop will draw down on different resources, materials and other affordances for learning. Some of these are internal to the CoP, such as being shown how to do something by a more experienced and knowledgeable other, for example when Mark trained Lawrence in building a new bike ready for test-riding or when Lloyd showed Ben how to fit lights correctly to a new bike (vignette two). These are examples of *mutual engagement* that generate opportunities for authentic learning that involve not only how to use the correct tools to perform specific technical tasks but also how to use particular examples of the jargon or discourse of the community (Rock, 2005). Others rest on external resources or materials, and these might be 'official' trade or industry resources such as the Cycling Prophet (vignette one) or 'unofficial' resources that have, over time, become established as being trustworthy and dependable such as the Sheldon Brown website (vignette three) – new additions to the *shared repertoire* of the community. At other times, the need to complete a particular task will necessitate what at first look might seem to be an individualised process of autodidacticism (watching a video before attempting a complex repair) but is in fact as much an aspect of a socially-mediated practice of learning (discussed below) as is anything else that is found within the CoP: for example, when Simon uses online resources to help him get ready for a complex e-bike repair that in turn generates interest amongst his colleagues (vignette three) or when Alex uses the Cycling Prophet website before helping a customer set up their new bike (vignette one).

At the same time, inbound and then insider trajectories are mediated by the indigenous practices of the Bike Shop as a CoP as they engage with the *joint enterprise* of the community in greater depth. Learning how to build a bike for test-riding (vignette two) is an aspect of practice that is mediated by the expertise of the technicians (the old-timer telling the newcomer what to do and when), the tools that are required (the old-timer telling the newcomer which tools to use, and how to use them), and the specific requirements of the bike being assembled and made roadworthy (which will impact on what instructions are given and what tools will be required). But it is also an aspect of practice that is reified in textual form (Wenger, 1998), captured in the completion of the Universal Buildsheet – a literacy artefact (Defoe, 2004) that simultaneously serves as both prompt and checklist for the tasks required in building a bike, and as an auditable record for the work of the bike building having been done: should an error be found in due course, it becomes a straightforward task to identify whether or not the technician has simply overlooked something, or has made a mistake due to a lack of understanding or expertise.

A textually- as well as technologically-mediated world

The practices of The Bike Shop are mediated by an array of objects, mechanical tools of varying degrees of technological sophistication. Some are generic and might be found in all kinds of locations, including in a toolbox at home for doing odd jobs around the house. Others are of a significantly greater degree of sophistication and specialisation: these are found only in cycle workshops, and invariably require training in how to use them properly (misuse can damage the bike as well as the tool, and some of these tools can cost hundreds of pounds) and how to maintain them correctly: indeed, the correct set-up for some tools sometimes requires the use of other specialist tools in turn. They range from the artisanal to the industrial (Simondon, 1958). More unexpectedly (certainly from my standpoint upon commencing fieldwork) is the extent to which the practices of The Bike Shop are mediated by a rich, multimodal array of textual artefacts. Some are indigenous to The Bike Shop: the Workshop Jobsheet, the Universal Buildsheet, and the Workshop Job Special Order sheet – and there are others. Some are external to The Bike Shop and are appropriated and recontextualised for local use: the Sheldon Brown website, the YouTube videos, online diagrammatic schema, Cycling Prophet, Cytech certificates. Texts that need to have meaning made from them are even found inscribed onto components: for example, the maximum air pressure permitted for a tyre is always embossed on the side wall of the tyre.

Whether or not the artefact in question is a tool or a text, a diagram or a device, it is through the ways that they are used by the technicians that we can perceive learning as a social practice. As with any form of technological object, it is in how 'the apprentice who is seeking skill' slowly gets to grips with the appropriate ways in which to use the object or tool in question (Latour, 2013: 227), that learning happens. This is because, within any CoP, any single artefact or tool possesses the quality of *transparency*. Transparency, arguably one of several under-utilised elements of CoP theory (Tummons, 2022) ''refers to the way in which using artefacts and understanding their significance interact to become one learning process'' (Lave and Wenger, 1991: 102–103). Transparency is relational: it is not a fixed quality possessed by an object; rather, as the user of the object gains in expertise, knowledge, skill and experience, then the affordances, possibilities, techniques and even histories of the artefact or tool in question become more readily available and made sense of. Some of the tools in The Bike Shop such as a splined cassette removal tool (a tool for removing the block of cogs from a rear wheel in a racing cycle), become transparent more readily than others such as frame alignment measuring tools (tools for evaluating the extent to which a bicycle frame has become damaged). Likewise, some textual artefacts such as Workshop Jobsheets can be used fairly quickly by newcomers to the CoP, whilst others require more

substantial amounts of prior understanding and/or experience before they can be fully utilised, such as YouTube videos demonstrating e-bike motor replacement.

Learning in a community of practice

There is a lot to be learned at The Bike Shop. Technicians have to learn how to build new bikes according to the rubric laid out in the Universal Buildsheet, how to use esoteric tools that they have not encountered before, how to perform specialist tasks such as hub gear servicing or wheel building, how to carry out online diagnostics on e-bikes and record the results (one copy saved on file and the other given to the customer, in a manner akin to the MOT certificate required for motor vehicles (a compulsory annual test for safety and exhaust emissions)), and how to accurately diagnose mechanical problems and instal the required spare or replacement parts. They also have to learn how to use the online workshop booking system, navigate the different websites for manufacturers and distributors (in order to look up technical information or order new parts), and take accurate measurements in order to calculate the length of spokes needed for wheel building. They have to learn which components made by different manufacturer are nonetheless compatible with each other, which components are now obsolete and which can still be repaired – and which spare parts will be needed.

At first look, it might seem that learning to become a cycle technician requires 'only' the practice and acquisition of a range of predominantly technical skills and competences of increasing complexity. Through a familiar combination of prior and then ongoing hands-on experience and competence-based qualifications, a technician can obtain employment and then gain in proficiency and expertise. But learning how to replace components and install brake levers, rewire derailleurs or service bearings is not all that has to be learned. Technicians have to learn how to identify problems, how to communicate these to customers and/or colleagues, how to ask for help when encountering a novel problem, how to find information to resolve a previously unknown technical difficulty, how to train newer colleagues, and how to book in a bike for service using the bespoke workshop software. They have to learn the histories of the bikes that The Bike Shop sells and the histories of the marques that they repair, the techniques for maintaining components that are decades old as well as cutting-edge, which can be disposed of and which can be restored.

Becoming and remaining a cycle technician rests on a complex and fluid process of learning that will always, necessarily, be a socioculturally-mediated process. Becoming and remaining a cycle technician within *this* CoP – The Bike Shop – necessitates an ongoing engagement with practice which, as is the case within any CoP, means that members of the community are always learning. This learning is characterised by heterogeneity. The joint enterprise of the

community is self-evident – servicing, setting-up, repairing and upgrading bikes – but is rendered complex by the kinds or modes of practice that the joint enterprise rests on. The accomplishment of these practices requires specialist cycle tools, spare parts, and specialist bodies of expertise and experience as much as it requires capacities to source relevant online information, filling in paperwork, solving novel problems, and teaching and learning from colleagues. Becoming an remaining a cycle mechanic requires so much more than 'simply' knowing how to repair bikes.

Conclusions. The necessity of rich descriptions: ethnography, communities of practice, and technical learning and expertise

Communities of Practice theory derives from ethnography. The landmark empirical work that was used to generate the theory of learning that CoP theory rests on and then to articulate the construction of CoPs in more detail, was all ethnographic (Lave, 2011, 2019; Lave and Wenger, 1991; Wenger, 1998). CoP theory and ethnography are epistemologically and ontologically aligned: they share an interpretivist standpoint and a perspective on knowledge as socially mediated. Over time, some have charted the progress of CoP theory as it has become simplified in use whilst others have sought to explore, critique and enhance CoP theory through subsequent empirical research, including research focussed on learning within diverse workplaces.

As a lens through which to inform an ethnographic account of the learning of cycle technicians, CoP theory provides tools to think about both formal and informal structures, certificated learning as well as informal learning, the equal importance of materials, tools and artefacts as well as ways of talking and meaning – the shared repertoire of the CoP. This lens reveals all of the heterogeneous practices that make up the work done by cycle technicians that go beyond using tools to adjust and repair and include knowing about the histories of bikes and of components and the capacity to seek out new technical information, as well as the need to learn the more mundane practices that characterise any place of work – the joint enterprise of the CoP. And it reveals the ways in which technicians talk with each other, share stories and photographs of repairs that they have done, old cycles that they have rescued, workarounds that they have improvised, and new techniques that they have practised – the mutual engagement of the CoP. The technicians embody as well as articulate their craft within this specific social context, accruing bodies of expertise and competence of increasing complexity that speak to not only their greater engagement with the cultures of The Bike Shop, as a Community of Practice, but also their own private passions, as individual people, solving problems with creativity as well as experience, striving for excellence (Lave and Wenger, 1991; Wenger, 1998; Winch, 2010).

Thus, in order to answer the question *'becoming a bike shop worker: how do people learn how to become cycle technicians?'* we need to foreground the necessity for those same people to learn so many things that at first look do not really seem to be 'about' being a cycle technician at all. Yes, they need to learn how to rewire a derailleur correctly, how to index gears, and how to install a bottom bracket. But they also need to learn how to order new components from distributors, how to run the correct software for e-bike diagnostics, how to repair components that are no longer in production, and how to identify mechanical faults not only by sight but also by sound. Cytech, as the leading industry qualification, undoubtedly has an important role to play here. But as with any professional or technical qualification, Cytech can only reify a threshold level of knowledge and competence (Eraut, 1994). To fully explore and make sense of the multi-faceted and diverse learning of cycle technicians, and to recognise and then appreciate the complexity of the bodies of expertise and of knowing that they acquire and embody, an ethnographic lens – Communities of Practice theory – is needed. Through this lens, we can acknowledge and then celebrate the richness of what cycle technicians know and do, and perhaps wonder why, as highly skilled, reflexive, problem-solving technicians, they are not more widely valued.

Notes

1. https://www.bikebiz.com/uk-cycling-market-valued-at-2-31-billion-in-2020-reports-ba/; https://cyclingindustry.news/covid-boom-adds-1bn-to-uk-cycling-market-value-in-2020/.
   https://www.ibisworld.com/united-kingdom/market-research-reports/bicycle-retailing-industry/
   [date accessed 4-5-2022].
2. https://www.cytech.training/ [date accessed 4-4-2022].
3. https://www.cytech.training/ [date accessed 15-6-2022].
4. https://activatecycleacademy.com/about/ [date accessed 15-6-2022].
5. https://www.cytech.training//accredited-shops/index.php?searchtype=shop&page = 1 [date accessed 15-6-2022].
6. The names of the shop and of the staff referred to here are of course pseudonyms. Names of companies and manufacturers are not.
7. https://www.cannondale.com/en-gb/bikes/road/what-is-smartsense [date accessed 16-6-2022].
8. https://bikebiz.com/csgs-cycling-prophet-rewards-bike-shop-staff-for-product-knowledge/amp/ [date accessed 16-6-2022].
9. https://www.sheldonbrown.com/ [dated accessed 4-4-2022].
10. https://www.youtube.com/watch?v=KlJ1jRGMpjg [date accessed 27-6-2022].
11. https://www.ebikemotorcentre.com/bearing-identifier/ [date accessed 27-6-2022].
12. https://www.worldcat.org/title/sutherlands-handbook-for-bicycle-mechanics/oclc/761014014/editions?referer=di&editionsView=true [date accessed 28-6-2022].

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