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How artificial intelligence might change academic library work: Applying the competencies literature and the theory of the professions

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Abstract

The probable impact of artificial intelligence (AI) on work, including professional work, is contested, but it is unlikely to leave them untouched. The purpose of this conceptual paper is to consider the likelihood of the adoption of different approaches to AI in academic libraries. As theoretical lenses to guide the analysis the paper draws on both the library and information science (LIS) literature on librarians' competencies and the notions of jurisdiction and hybrid logics drawn from the sociological theory of the professions. The paper starts by outlining these theories and then reviews the nature of AI and the range of its potential uses in academic libraries. The main focus of the paper is on the application of AI to knowledge discovery. Eleven different potential approaches libraries might adopt to such AI applications are analyzed and their likelihood evaluated. Then it is considered how a range of internal and external factors might influence the adoption of AI. In addition to reflecting on the possible impact of AI on librarianship the paper contributes to understanding how to synthesize the competencies literature with the theory of the profession and presents a new understanding of librarians as hybrid.

1 | INTRODUCTION

In their book *The Future of the Professions*, Richard and Daniel Susskind predicted fundamental challenges to professional work from artificial intelligence (AI; Susskind & Susskind, 2015). They anticipated that in the medium-term professions would be dismantled and their role in expertise superseded by increasingly capable machines. It is an outcome they largely welcome, reflecting a critique of the professions that they are unaffordable, antiquated, opaque, and underperforming. However, writing early in the current phase of AI development, perhaps they were too bullish about the potential for strong AI and of it to operate without a "human in the loop." They were also writing before the current storm of concerns around privacy, bias and transparency had broken over AI (Jobin et al., 2019).

Frey and Osborne (2017), in contrast, in their equally seminal analysis, stress the disappearance of more routine roles through automation. Thus, they list "library assistant, clerical" as 95% amenable to automation and "library technician" as 99% at risk. However, the role of librarian is judged only 65% likely to be automated. And in general, it is equally easy to imagine human work being diminished or enhanced by AI. It could leave many workers as mere servants of the machine. Equally it could automate routine, freeing up workers to focus on the more creative and social aspects of

work that are beyond automation. Willcocks (2020) tries to dispel the hype-fear narrative that surrounds the current wave of automation for employment as a whole. Jobs will be created as well as lost. There will be disruption but there will time to adjust, he suggests. Helpfully, the Global Partnership on Artificial Intelligence (2020) offers a comprehensive list of the potential impacts that AI might have in replacing, complementing, dominating, augmenting, dividing or rehumanizing work. Perhaps all these will happen to some degree, in different areas of work, at different times. Perhaps some work will remain fundamentally unchanged.

Thus, the possible impact of AI on work, including professional work, remains contested and hard to predict. What might be possible is to anticipate the impact in particular areas of work. In this context, the purpose of this conceptual paper for the special issue on AI and work is to consider the potential impact of AI on the professional work of academic librarians.

The paper locates itself in two bodies of literature as lenses for undertaking the analysis. The first is the abundant LIS literature on professional competencies. Often written by practitioners and educators such writing offers detailed descriptions of the skills and knowledge required to perform new professional tasks. The second is the more critical and theoretical work from the sociology of the professions. The intended contribution of the paper is to use these lenses to analyze the likelihood of the adoption of different approaches to AI in library work, primarily in the key area of knowledge discovery. It also seeks to explore how these lenses inter-relate and can be used together. In constructing what is essentially a conceptual exploration the author is informed by his previous work on episodes of change in the profession analyzed using the theory of the professions (Cox & Corrall, 2013; Cox, Gadd, et al., 2019; Cox, Kennan, et al., 2019; Cox, Pinfield, & Rutter, 2019; Verbaan & Cox, 2014) and more specifically his empirical studies of the application of AI in information contexts (Cox, 2021; Cox, Gadd, et al., 2019; Cox, Kennan, et al., 2019; Cox, Pinfield, & Rutter, 2019). As the author is more familiar with the environment of the UK academic library the comments are more confidently asserted for this context, but much of the logic may well apply in other geographies.

2 | THE LITERATURE OF PROFESSIONAL COMPETENCIES

The rapid evolution of professional library work is captured in the class of LIS literature that deals with professional competencies. Professional bodies seek to list relevant competencies and update this regularly to reflect sector developments. The UK's professional body, CILIP, released a revised Professional Knowledge and Skills Base in 2021, for example. In new areas of specialist work—such as AI would be—research papers explore the knowledge, skills and attitudes needed to work in the area. A good example of this form of writing is around the relatively novel library professional practice supporting research data management (RDM) and data curation (e.g., Federer, 2018; Kellam & Thompson, 2016; Tammaro et al., 2019).

Publications in this genre are based on content analysis of job postings (or sometimes actual job descriptions) or surveys of professionals working in the emergent field. Thus, they reflect changes already happening at the level of practice. They are often written by practitioners themselves seeking to create a stronger professional community and understanding of their own new role. They reflect a desire to clarify the nature of a new area of professional work, its training needs and perhaps also to raise its status. They often make parallel suggestions for curriculum development at library schools, reflecting the way that new knowledge, skills, or attitudes are needed to perform the work. Quite often the professionals working in an emergent area are claimed to be a completely new professional grouping since they have skills beyond those which are deemed standard to the profession. The new practice may demand new ways of thinking and new forms of collaboration. For example, there are those who have seen data librarianship or "databrarianship" as a new profession (Kellam & Thompson, 2016; Koltay, 2019).

Sometimes such emergent roles include significant elements of the skills of other professional groups. Corrall and Cox (2008) dubbed these "hybrid professional" roles. Thus, the librarian working in RDM could be seen as hybrid between the work of a librarian, a researcher, and an archivist. Such a person could also potentially be what Whitchurch (2012) refers to as third space professionals, though this term relates more to novel roles emerging between professions (Verbaan & Cox, 2014).

The strength of the LIS competencies literature is in clarifying and sharing understanding of the knowledge and skillsets needed in a new area of work at a high level of detail: guiding new entrants to seek the right skills, employers to create job descriptions, and professional bodies and educators to refresh the curriculum. This literature can also be read as a claim for new territory. Sometimes the attempt is made to show that the knowledge required is essentially something library professionals already have (e.g., Cox et al., 2012). But such writing can also be seen as quite expansive, even aggressive. For example, the core skills of RDM seem more akin to those of the archivist than the librarian, yet it is the larger, better resourced profession of librarianship that has seemed to expand its remit to encompass this work (Verbaan & Cox, 2014). This point prompts us to think more critically about how professional work changes. The theory of professions might dig deeper into what is going on here.

3 | THE THEORY OF PROFESSIONS

This body of sociological theory suggests that professions are occupations distinguished by their relation to knowledge (Abbott, 1988; Freidson, 1988). The professional's expert knowledge enables them to solve the problems of their clients. Ideally this knowledge is generalized to abstract knowledge that is hard to replicate. To acquire the abstract knowledge aspiring professionals need to go through extensive training. Expertise is recognized in higher status and rewards. Given that their work is based on expertise the professional must be given autonomy in their decision making, but this implies the need for a code of ethics, regulated by the profession, to ensure their power is not abused. From this logic we get the key features of a profession: a high-status form of work based on an abstract body of knowledge that is efficacious in solving clients' problems, accreditation, and autonomy balanced by a code of ethics.

Occupations have to go through a long-term collective process to try and win the exclusive right to a certain area of work. If this struggle is successful a profession may gain the exclusive right to practice. Thus, it is a legal requirement in many countries to have successfully passed through an accredited training program to be allowed to practice as a medical doctor. In other professions credentials are needed in a weaker form (as in librarianship in many contexts). Over time the expert knowledge can be eroded, so that an occupation's journey toward professionalization is not a once and for all achievement (Abbott, 1988). The knowledge base of librarianship is often perceived to be under such threat. Traditionally librarianship's jurisdiction was based on access to information, in the form of books in the library (Abbott, 1998). This is usually seen as vulnerable in the age of the internet when information is abundant. O'Connor (2009) has suggested that the jurisdiction has shifted in the direction of the information literacy aspect of education.

Abbott (1988) suggests that professions continuously compete with each other for jurisdiction over areas of work: seeking exclusive control over activities on the grounds that their knowledge base can best solve the client's problem. Abbott (1988) suggests that while exclusive control is an aspiration, adjacent professions may reach some form of settlement:

- Subordination, where one profession controls the work of another.
- Split jurisdiction, where a task is divided among two professions.
- Advisory settlement, where one profession controls the task, but receives advice in certain areas.
- Client differentiation, where different professions work with different types of client.

In Abbott (1988) there is a sense of continuous competition between professions for jurisdiction, played out in the public realm and at the workplace level. Thus, the progress of a profession is not simply tied to its own collective action but achieved in competition with other occupational groups. In fact, through this lens the competencies literature that this section began with represents a claim to new territory.

Abbott (1988) recognizes that professions are not unitary communities and that elite groups can emerge within them, challenging their identity and collegiality. He also recognizes that the organization is an alternative way of organizing knowledge and work. More recent writing such as that of Noordegraaf (2007, 2015) thinks through these ideas further (see also Adams, 2020; Currie & Spyridonidis, 2016). Noordegraaf (2015) suggests that when a profession is embedded in an organization two, dualistic institutional logics are at play: on the one hand the logic of the profession, on the other, the logic of management. Institutional logics are "symbolic and material patterns of beliefs, values, and interests that shape power and social action" (Adams, 2020, p. 102). The logic of profession is about the autonomous application of specialist expertise. The logic of organization is about corporate purposes and top-down control. More formally, Noordegraaf (2015) draws a contrast between their underlying principles at three levels. First, coordination is achieved by skills and norms in professionalism but by hierarchy and markets in managerialism. Second, authority is based on expertise and a service ethic in professionalism but established by results and accountability in managerialism. Third, the values of quality and humanity in professionalism are contrasted to those of efficiency and profitability which are dominant in managerialism.

There are various potential responses to this tension between differing logics (Noordegraaf, 2015). The profession may resist the incursions of management. Or it may fall under control of mangers as "controlled professionalism" (Noordegraaf, 2015). But an important possible outcome is what Noordegraaf (2007) calls hybridity. This refers to the way that individuals, especially those in the elite of the profession, seek to pursue both institutional logics at the same time despite their inherent tensions. This is possible because neither logic is monolithic and is always open to interpretation in a particular context (Currie & Spyridonidis, 2016). The use of the term hybridity is rather similar to Corrall's (2008) but it is based not on the fusion of the knowledge of two professions, rather it talks about the synthesis of the different institutional logics of a profession and of managerialism. Certainly, the result is conflict, complexity, and the

blurring of boundaries, but the resultant "managed professionalism" may actually be deemed an empowering outcome for some (Noordegraaf, 2007). Whereas for Abbott seeking a controlling jurisdiction is the strongest position, by this logic, a hybrid position proactively balancing the discourses of both professionalism and managerialism is a powerful position.

Given the growing power of management thinking in this and the last century, including within higher education—the "new managerialism" (Deem & Brehony, 2005)—this seems a highly relevant process for the analysis of academic library work. Librarians are professionals but working within a wider institution that is increasingly the subject of management control. We can see the kind of trends discussed by Noordegraaf and others manifested in the erosion of professionalism, for example, the employment of noncertified librarians in certain types of role, such as in research and scholarly communications support. Increasingly the discourses of the profession, such as focus on user need, implying the value of professional understanding, clash with discourses of customer satisfaction that fit better with managerialism. Sometimes the clash between the logics creates resistance, such as in critical librarianship with its uncompromising rejection of managerialist approaches (e.g., Nicholson, 2015). But often we see hybridity. John Cox's (2018) work on the positioning of libraries in relation to institutional purposes and strategies reflects this sort of thinking. Here the alignment of the professional organization of the library to the priorities of the wider institution within which it sits is considered central to strategy. How it can contribute to the achievement of institutional goals is given emphasis over professional values. This can certainly lead to internal conflicts, such as when senior library management pursuing hybrid purposes clash with librarian members of staff standing up for a purer form of traditional professionalism (e.g., subject librarians). Yet within the institution the library director's ability to draw on both the professional expert discourse and on managerialist discourse could be considered the basis for a very powerful position. It might appear weak from Abbott's jurisdictional perspective because he stresses the strength of the position where professional knowledge has unrivaled application to a problem. However, hybridity reflects the potential strength of actively balancing two institutional logics. Indeed, one could imagine librarians seeking to actively shape institutional priorities, not merely align passively to them (Pinfield et al., 2017). This analysis seems to better reflect the realities of academic librarianship as a rather resilient professional group exploiting professional and managerial logics.

Thus, the theory of the professions offers a wider perspective on the positioning of librarianship than does the competencies literature. It considers more underlying processes, occurring among many professions. Both lenses share a focus on professional knowledge. The competencies literature has significant value in identifying quite precisely the skillsets needed to take on new work. It serves a very practical purpose to inform the reader about emerging areas of work and what is needed to be employed in this area. The detail is also helpful in assessing the likelihood of future scenarios. An approach rooted in the theory of professions is more analytic in differentiating the logic of the profession and how this contrasts to the institutional logic of managerialism. It is perhaps also more centered on identifying the core knowledge base and core areas of jurisdiction than more newsworthy areas of emergent activity emphasized in much of the competencies literature. It suggests caution about endlessly extending the scope of a profession's work as it dilutes the clarity of its core jurisdiction. It is also more critical in uncovering the issues of power, inequalities and conflict that do surround professional work. The paper seeks to leverage the value of both lenses.

4 | THE IMPACT OF TECHNOLOGY ON PROFESSIONAL WORK

Technology plays an important role in both literatures that have just been reviewed. New forms of professional practice often arise from the arrival of new technologies. For example, the need for RDM support is often at least partly attributed to the scale, value and fragility of digital data being produced by big science. New practices require professionals to acquire new competencies. Equally commentators such as Abbott (1988) recognize the way that technologies disrupt existing jurisdictions, creating new areas of work but also removing the value of some types of expert knowledge, and so eroding previously established jurisdictions.

Again, the work on hybridity offers further insights. We can argue that technology, while capable of being used to many ends, is often aligned to managerial values, such as when it promotes efficiency, cost saving, and so forth (Mirza & Seale, 2017). This is reflected in Mirza and Seale's (2017) critique of the technological determinism and solutionism inherent in much of librarianship's response to technology. They see a technological ideology of rationality and progress as hostile to ideas of service and care inherent in professional ideals. Accepting this contrast, following Noordegraaf (2007) we can argue that a hybrid professional can seek to integrate the logic of the profession and the logic of management, when represented by technology. Active balancing of the two logics allows one to draw strategically on the powerful

TABLE 1 Librarians' attitudes to technology

	Explanation	Skills needed	Form of jurisdictional settlement
Expert	Develop technologies, learn to code, and so forth	Computational thinking	Subordination to IT
Customizer	Adapt technologies to local needs	A weaker form of computational thinking	Split with IT
Commissioner	Commission technologies based on an understanding of strategic needs	Strategy, manage commission process, negotiation	Full or hybrid (with the institutional logic of management)
Interpreter/ translator	Act as bridge between users and technologies. Understands how to speak in both languages	Technical language and possibilities	Advisory
Follower	Technology is inevitable—Just go with it. Late adopter	Strategy, manage commission process, negotiation	Subordination to IT
Luddite	Anti-technology because of link to commercialization/managerialism and loss of professional freedom	None	Full
Avoider	Anti-technology traditionalist	None	Full

discourses of technology but temper them with professional ideals. Equally many technologies are not merely vehicles of efficiency.

These contrasting potential outcomes of new technologies probably explain why the library profession could be said to have a complex and often ambivalent relation to information and communication technologies. Much of the literature reflects technological solutionism or even technological deterministic thinking. Yet there are also strands of technophobia even luddism.

Thus, it may be useful in the context of analyzing the response to AI to reflect on the positioning of the profession toward technology in general through both the competencies and theory of professions lenses. Extending Read and Cox's (2020) analysis of scholarly communications librarians' orientations toward technology, Table 1 analyses common stances through both the competencies lens and the lens of Abbott's notion of settlements between competing professions.

While becoming an expert in technologies would seem to be a powerful individual career strategy and perhaps advocated within competencies literature, from Abbott's jurisdictional perspective it is subordination, because it pictures a professional depending on the knowledge base of another profession rather than its own. It is implying that knowledge of technologies—computational thinking (Wing, 2006)—is more efficacious in solving work problems than the professional knowledge base of librarianship itself. This would be an explanation of why Read and Cox (2020) found this position relatively rarely adopted by professional librarians. In contrast, commissioning technology implies that professional knowledge is the determining force in selecting technologies, so can be interpreted as a settlement in which computational thinking is subordinated to the full control of the librarian. Equally, if we see librarianship as hybrid in Noordegraaf's sense we could interpret this stance as reflecting a managerial position in relation to IT. This was a relatively common position, Read and Cox (2020) found. Another stance is as customizer, this could be seen as a split jurisdiction, because the core technology is built by another professional (in IT) but a major part of making it work locally is customization based on the librarian's professional understanding of user need. As such this could be viewed as a hybrid role between librarianship and IT (Cox & Corrall , 2013). Another common stance that librarians articulated in the Read and Cox (2020) study is as an interpreter or translator between technologists and users (or their needs). This could be considered an advisory settlement. The technology avoidance, even luddite stance, driven either by traditionalism or the critique of technology as leading to commodification, while hard to sustain, could be seen as reflecting an assertion of pure professional values and implies a claim for full jurisdiction over work based on the ideas of librarianship itself. This analysis tells us something about different professional postures toward technologies and how they could be interpreted from the theory of the profession perspective. It may inform our thinking about how AI is received.

5 | AI AND ACADEMIC LIBRARIES

If the previous sections show that the notion of professional work in LIS turns is both complex and contested,

much the same could be said of the "technology," AI, whose impact on professional work this paper seeks to uncover. The term AI has many connotations arising from a strong public imaginary, fueled by science fiction and other popular media forms. In fact, AI is probably much better understood as an evolving idea rather than a single technology. Through the evolution of technology, of conceptualizations of our relation to technology and of intelligence itself notions of what AI might mean have evolved. As a result, since the 1950s AI has been instantiated in different technologies in AI springs, followed by periods of disillusion, AI winters.

At the time of writing the term AI is often used as an umbrella term for multiple technologies. Thus Gartner (Lowendahl & Calhoun Williams, 2018) identity "six core interconnected AI technologies": business analytics and data science; natural language processing, speech recognition and text to speech; machine learning, deep learning, and neural networks; machine reasoning, decision making and algorithms; computer vision; and robots and sensors. Similarly, Bughin et al., (2018) suggest that "AI capability" is made up of: robotic process automation; computer vision; machine learning; natural language text understanding; virtual agents or conversational interfaces; physical robotics; natural language speech understanding; natural language generation; and autonomous vehicles. This means that the scope of AI is broad: it could be a technology for the automation of routine office processes like robotic process automation (RPA), a form of weak AI which involves the automation of a prescribed task. Equally, it could be something more at the end of strong AI, which has capacity to operate in multiple contexts, such as unsupervised machine learning or deep learning. Given that the technologies are also spreading at a differential rate across sectors unraveling the impact of AI is challenging. A few authors such as Goto (2021) have begun to try and understand this in specific professional contexts.

The impact of AI on academic library activities is therefore likely to be no less complex (see Cox, 2021 for a review of the options). The rate at which it enters the library space is likely to be driven by much wider technical developments and so is beyond the control of librarians. Table 2 identifies the main areas of application of new technology that might be reasonably labeled AI (Cox, 2021). Some of these are in fact already familiar even commonplace; some remain cutting edge and some others could conceivably never materialize. Search engines use AI and we are familiar with this (row 1). In many respects this represents the strongest threat to the perceived need for professional librarians, but we can argue that librarianship has come through this battle by successfully propagating the view that AI supported search does not remove the need for information literacy. Library systems have attempted to emulate some of these new functions (row 2). There is current interest in an AI interface to library systems called YewNo, recently acquired by Exlibris, for example. Conversational agents or chatbots have been proposed as a useful application in library work for nearly 10 years; similar claims now being made to customize voice assistants for use in a library context (row 4). In practice, there does not seem to be much evidence of widespread take-up and we might speculate that either library queries are too varied to be efficiently addressed by automated means or that it could reflect professional resistance to a technology that might replace professional roles in the name of efficiency. AI techniques have potential application both to the management of users (e.g., via learning analytics) or marketing (e.g., using social media analysis; rows 5). These would be uses strongly aligned to a managerialist logic since they provide data to inform decisions or even automate decision making. Again, evidence of take up is as yet a little patchy, particularly as regards methods that identify individual users. This might be interpreted as professional values stressing freedom and confidentiality, in opposition to efficiency logics. RPA has potential applications in routine academic library work, for example, processing bibliometric data. As such it is appealing in terms of efficiency or from a managerialist logic. This is an area where human jobs in libraries might be lost, but since those would be routine it might meet less resistance professionally. Concepts of the smart library, a library space managed through sensor data, IoT, and so forth are another dimension of AI for libraries (row 7). Column 2 speculates about some of the skills that might be needed to develop academic library applications in these areas, showing that the skills demanded in each case are different. Column 3 offers an analysis based on the notions of jurisdiction and hybridity.

Rather than attempt to address this wide range of changes in depth, this paper focuses on the use of AI for knowledge discovery (row 4) because it is the potentially most profound one. AI in knowledge discovery, like many implementations of AI it is not wholly new even in library related applications. A significant amount of work in digital humanities already seeks to use AI to conduct research in libraries' unique historic "collections as data" (Cordell, 2020). Other scholars are using machine learning, but not with library data, for example, in the analysis of social media data or scientific data. Another important application of relevance is in the mining of published literature. Given the scale of scholarly publishing undertaking a systematic or comprehensive review is increasingly challenging in many fields, and scholars are turning to AI to cope not with big data but with "big literature."

TABLE 2 Artificial intelligence (AI) applications in academic libraries

	(1) AI applications	(2) Skills needed	(3) Jurisdiction/hybridity
1	Everyday web and mobile search	Understanding of how it works/training (of users)	Threat via smart technology simply replacing need to access library for information yet strengthens the need for information literacy and so educational jurisdiction
2	In existing library systems, for example, search interfaces	Training users	Strengthens the access jurisdiction
3	For knowledge discovery, such as licensing an AI product, offering collections as data, or supporting communities of AI users	See Table 3 for the range of skills required for 11 different options	See Table 3 for the implications for jurisdiction
4	Conversational agents and voice assistants	Building knowledge base, skills for creating conversational agent (coding)	Limited impact to date in practice but could substitute for professional roles in the name of management efficiency
5	In user management—for example, learning analytics, library analytics, sentiment analysis	Data analysis, data science	Could strengthen an educational jurisdiction by giving more data on information need, but could also be seen as strengthening management logics
6	Robotic process automation—for example, applied to back end systems	Analysis of systems, coding	Makes some tasks more efficient, but unlikely to reduce professional work
7	Smart library	Sensor data analysis	Reinforces the access jurisdiction by improving understanding of use but could be seen as subordination to IT

Librarians work around text and data mining is relevant here (White, 2020). The logical extension is that any library collection should be accessible by machine learning: rather than searching a library catalogue to locate a book to read, readers will want to navigate the entire collection using machine learning tools. The collections become accessible to computation as data and this does not need to be restricted only to texts, but can include images, audio, and other material. When all collections become data, profound questions about the nature of the library are posed (Cox, Gadd, et al., 2019; Cox, Kennan, et al., 2019; Cox, Pinfield, & Rutter, 2019). Indeed, increasingly AI may not only be able to provide analysis but also outputs in the form of publishable summaries of literature. The first book of literature review written by AI was published in 2019 (Schoenenberger, 2019). This could be very challenging for a profession whose status one could characterize as based on the high cultural status of the written word. It is interesting that McKinsey Global Institute (2018) predict rather static growth for jobs based on "advanced literacy and writing" compared to those based on the digital and quantitative data. Certainly, the realization of this vision is some way off, but as machine learning tools are often open source and are becoming easier to use and more effective so more researchers will wish to use them in all disciplines. Indeed, we can expect a growing number of academic researchers to want to use AI techniques to reflect their growing use in society. AI competence is likely to be added as a necessary skill for students to learn not just in data science. Together these examples suggest that there is reason to think that there will be a long-term movement toward AI in knowledge discovery, so it is important to think through how this might impact the library profession.

6 | AN ANALYSIS OF APPROACHES TO ADOPTING AI FOR KNOWLEDGE DISCOVERY

Table 3 offers an analysis of some of the options in adopting AI for knowledge discovery in the academic library context. They are based on extending the logic described in literature about services to support digital humanities, the use of machine learning on library collections and an emerging literature around supporting data science (Burton et al., 2018; Cordell, 2020; Koltay, 2019; Lewis et al., 2015; Maxwell et al., 2018; Oliver et al., 2019; Padilla, 2019). Many were previously identified in Cox (2021). They remain theoretical speculations rather than empirical observations, which is

justified because we know it is early days for AI (Cox, 2021; Wheatley & Hervieux, 2019). The first column in the table is a label to describe each of the possible approaches, with the next column offering a more detailed description of what is involved in each case. Many of these options are not so much about the library applying a particular form of AI, rather they are about supporting a wide range of AI used by others. The next column views the approach through the lens of competencies to speculate at a high level about the skillsets that might be needed to operate it. The next two columns summarize the risks associated and the resource cost. These are based on the logic of the choice, though it is possible future empirical data will show them to be incorrect. The next column estimates the likelihood of the approach being adopted based on the balance of risk and resource cost and demand on skills, with 1 meaning highly likely and 5 highly unlikely. Previous work in RDM pointed to the tendency of libraries to take on roles which are extension to what they already do, partly because of skills availability (Cox, Gadd, et al., 2019; Cox, Kennan, et al., 2019; Cox, Pinfield, & Rutter, 2019). The final column offers a theoretical analysis based on jurisdiction and hybridity. The table is presented in order of likelihood, from the most likely to the least likely approach.

Approach 1 is labeled the "project" approach. In this approach, projects using AI would be initiated, partly as a strategy to further develop relevant skills. It is an exploratory approach. The skills required boil down to project management. It is rated as high in likelihood because it involves a narrow range of generic skills and is low cost and low risk. No definitive claim of jurisdiction is being asserted.

Approach 2 is labeled "do nothing." There is currently ample evidence that libraries are not engaging intensively with AI (Wheatley & Hervieux, 2019). By definition no resources or skills are required for this stance, but there is a risk attached to it of being seen as not attuned to current trends and in the long-term being displaced by another professional group. For a hybrid profession it is hard to avoid AI as a rising agenda. Having no stance toward it is potentially untenable, but conservative elements and resistance to change is always present. So, this approach is rated only as likely. From a jurisdiction perspective it is being assumed that another profession has full jurisdiction over this form of AI—or it is simply not relevant.

Approach 3 is labeled "licensing a proprietary product." There are already several proprietary platforms offered by publishers for text mining of content, mostly of published literature. Licensing one offers ready-made access to the technologies and support. The skills needed in this approach are, first, in procurement to choose the right system and, second, in marketing and support to create a user base. These platforms are rather expensive so can be seen to demand significant financial resources, perhaps necessitating job cuts elsewhere. They also jar with the open access ethos that libraries are usually positioning themselves to promote, so could be deemed to be risky. Overall, this option is rated as likely, partly because it seems that academic libraries would be attracted to take the approach of buying in third party products, especially in areas where the skills required to develop a solution are high because of the complexity of the technology. Jurisdictionally it could be viewed as a strong position insofar as it is librarians' professional knowledge of user needs that controls the work involved: choosing and promoting use of a system. Yet the cost could require staff cuts elsewhere.

Approach 4 is labeled "offering collections as data for AI." This refers to the potential to offer up the library's own unique collections to users to perform analysis, making the library central to AI initiatives (Cordell, 2020; Padilla, 2019). The skills required are very much the traditional ones of collection management, metadata, and data management, and digitization. Costs are medium because much of this work might be done anyway. One risk is around the limits of research interest attached to the collection. It is a much more obvious strategy for an academic library in a research-intensive institution and that has a strong research collection, than for a teaching-oriented university, for example. So, it can be deemed likely for the former, less likely for the latter. Another risk is that automated tools displace traditional metadata creation skills. From a jurisdictional perspective it can be thought of as refreshing the traditional access jurisdiction of the profession around a collection; even more so if, as seems possible, the range of data content that libraries procure or manage widens significantly. Large research data repositories could become a key part of library collections. On the other hand, if AI approaches radically reduce manual metadata creation there could be impacts on professional roles in that area. Management logics might be dominant if AI was essentially being used to save resource on metadata creation.

Approach 5 is labeled "supporting an institutional community led by data science academics." Here the library is offering services to a community of users (Lewis et al., 2015). Services that might be relevant would be around training in the choice and use of tools, in discovering and accessing content for analysis, and in copyright. This could support a wide range of AI used by data scientists across the disciplines, not just text mining, as implied by Approach 3. The skills demanded are those of being a good collaborator, in addition to those for

TABLE 3 Potential academic library approaches to artificial intelligence (AI) for knowledge discovery

Approach	What is involved	Skills needed	Resource cost	Risks	Likelihood	Jurisdiction/hybridity
1. Project	Building toward another type of involvement; skill development	Project management	Low	Temporary involvement	1 Highly likely because low cost/risk	Noncommittal
2. Do nothing	Nothing	None	None	Risk of being seen as not in tune with latest trends	2 Likely	No claim
3. License a proprietary AI product	Evaluation and support of third party products	Procurement, marketing, support through knowledge of users, bridge to IT services, understand potential of technology	Med	Vs open access ethos, limited by aggregator content, cost	2 Likely	Full jurisdiction claimed—based on knowledge of users or managerialist
4. Offer collections as data for AI	Collection management, metadata, data management, provenance—management of bias	Collection management, data management digitization, and so forth	Med	Have to have or acquire unique resources Impact on traditional cataloguing roles	2 Likely for research intensive/low for other	Full jurisdiction—based on access to collections or managerialist if driven by efficiency saving
5. Support an institutional community led by data science academics	Library as service, for example, some help with things like copyright, training, choice of tools	Community participant, professional skills for example, in copyright, training	Low	More marginal involvement	2	Weak advisory
6. Build institutional AI community	Neutral space, copyright expertise, support to software tools, training, acquire content Ethical issues central	Depth of expertise in copyright, tools, training Ethos of openness, sharing, and so forth, community building	Med	Hard to sustain, based on personal networks	3	Strong advisory or even a managerial role toward other professions
7. Participate in extra-institutional support community	Contribute content, time, signpost the service to users	Collaboration skills	Med	Needs community to exist	4 Unlikely because community does not exist	Weak advisory
8. Customize AI products to local needs	Take AI products and customize them to local needs	AI skills	High	Risk of heavy investment for low return	4 But require skills and resources	Split jurisdiction

(Continues)

TABLE 3 (Continued)

Approach	What is involved	Skills needed	Resource cost	Risks	Likelihood	Jurisdiction/hybridity
9. Resist	Ethics and human values opposing bias	Values and ethics	Low	Risk of being seen as not in tune	4 Unlikely because tech love in profession	Full jurisdiction
10. Create infrastructure which is tool agnostic	Create an infrastructure for data science across the institution	Infrastructure, workflows, storage, and so forth	Med	Skills lacking	4	Subordination
11. Build own AI	Create own AI tools	Data science, AI	Very high	Skills lacking	5	Subordination

training, data discovery and copyright. The costs are low, but the risk is of being relatively marginal to important developments. So, it is a likely strategy. From a jurisdictional perspective it would be seen as advisory, because the main activity of text mining is led by the data scientists, and the library is seen as essentially offering advice on matters peripheral to the central task of data analysis.

Approach 6 is labeled "building an institutional AI community." This is similar to Approach 5 but places the library in a stronger leadership role. The case for this would be the value of the library as a "neutral space" plus expertise in areas such as copyright and training users in software tools and acquisition of content (Fenlon, 2020). This clearly implies higher level skills in these areas in the library. More resources are also needed. The risks relate to sustaining the community, particularly if key individuals leave the institution. So, it is a less likely approach than 5. Here the library is closer to splitting jurisdiction with researchers, but it could also be a form of managerialist control over academics.

Approach 7 is similar to 5 and 6 but based on participating in a wider support community beyond the institution. By definition more collaboration skills are needed, but other types of skills would be shared. Costs are shared. Risk is lower. In the context of the strong models of collaboration and consortia working in the sector this must be considered relatively likely. The barrier is with the sustainability of extra-institutional communities.

Approach 8 is customization. This is a variation on Approach 3 where a licensed product undergoes significant local customization. More technical skills and resources are needed, so it is probably a less likely option. It would imply a split jurisdiction because while librarian understanding of user need would be important other professions' expertise would need to be drawn on to design the base system.

Approach 9 appears to be very similar to Approach 2, doing nothing. Here, though, AI is actively resisted as not compatible with the culture of the sector or for ethical reasons. There has been a huge amount of controversy about the ethics of AI (Jobin et al., 2019). Much mirrors the debate in the area of library analytics where librarians have found many objections on ethical grounds to the exploitation of data about users (Jones, 2019). AI is based on data, so many of the same issues apply. The ethical issues are less glaring in knowledge discovery, but it is certainly the case that biases in algorithms and in collections do pose distinct ethical challenges to the uptake of AI (Cordell, 2020; Padilla, 2019). Overall, this is deemed quite an unlikely scenario. It would be viewed as an assertion of full jurisdiction, where librarians' position based on professional knowledge is more important than technical knowledge.

Approaches 10 and 11 imagine libraries taking a much more leading role in developing infrastructure or AI technologies. Both would require engineering or data science skills and be resource hungry. Most UK libraries probably do not have the technical capacity to pursue these approaches and would be trespassing into the expert areas of other professional groups (IT services) by doing so. As a result, they are deemed unlikely. From a jurisdictional perspective they imply subordination. Librarian professional knowledge is largely irrelevant to the work, so taking it on implies subordination to the jurisdiction of IT.

These are logically possible approaches and estimates of their likelihood must be considered speculative. They are not entirely mutually exclusive: in the messiness of reality, particularly if examined over an extended period, an individual library could position itself in multiple ways. For example, it could buy a proprietary product, offer up its own collections and build a community. The degree of community support captured in Approaches 5, 6, and 7 could be seen as lying on a spectrum.

7 | CHOOSING BETWEEN APPROACHES

From the perspective of the competencies literature professions do expand their skills base and add additional competencies to capture new areas of work. Table 3 itemizes some of the skillsets needed. All are potentially possible. Advocates might argue strongly for the extension of librarians' skills. Yet the ability to do this must be tied both to the number of staff and attitudes in terms of flexibility and willingness to learn new skills. Academic librarianship seems relatively dynamic in this respect given the way it has developed many new specialisms (Cox & Corrall, 2013). It is hard to untangle whether this is a defensive attempt to replace the threatened access jurisdiction or a more enterprising, even aggressive attempt to claim new territory. While there has long been soul searching about the changing role of the profession, this could be interpreted to derive from a form of purism and nostalgia for a period of supposed clarity and consensus around professional values. But if we recognize that shared jurisdictions and hybridity between professional and management logics are strong positions which respond to the complex pressures on professions in organizations, as Noordegraaf (2007) argues we are more likely to feel this is a necessary way of being.

In Abbott's theory there is a focus on the efficacy of the professional knowledge base in fixing problems. This is the basis of jurisdiction. The profession will claim new work if its knowledge base addresses the problem at hand. By this logic, approaches that require core skills that the profession already holds are much more likely. Thus Approach 3 is very much rooted in the traditional librarianship jurisdiction, so must surely be very appealing. Approaches 5, 6, and 7 would imply a more limited involvement, but draw on aspects of the professional knowledge base, for example, in copyright and training. Other options may be resisted by the same logic (as in Approach 9).

In the hybrid logic there is a sense that while professional values of quality and services are pursued, equally managerialist logics of efficiency, accountability and customer orientation are also drawn on. This could be used as a justification, for example, to reduce the human role in creating metadata around collections. On the whole, the approaches to AI discussed in the previous section are not ones driven by the logic of efficiency saving. Some of the options described incur other types of resource cost than staff time and skill, for example, licensing a third-party platform is expensive so access is premised on having available budget. So, resource richness would be also a factor in choices as well. Thus, the explanation here is rooted in management issues rather than professional knowledge. Such aspects of skill and monetary resource could be the main internal factors shaping how a library responds to the challenge/opportunity presented by AI, only time will tell. But it would also be the case that attitude to risk might play a part. Contingent events may have an effect too, for example, some library directors might simply have an interest and choose to pursue AI development for that reason.

There are also external factors in play. First, within the institution there could be other professions keen to compete for the work, such as the IT service or academic departments and centers. There might be a struggle to claim the new space, reflecting Abbott's (1988) focus on competition for jurisdiction between professions. The role of institutional management would also be a key factor shaping what are deemed priorities. Library directors, working in the hybrid territory between professional and institutional logics are likely to seek to synthesize the pressures. This might be one area where they seek to set the institutional agenda. However, if university policy sought to adopt AI for image purposes or to gain efficiencies, the conditions under which decisions were made about use of AI in other areas of activity would be affected. There would also be influences from the institution in terms of resources available and attitudes to risk.

The choices of actors beyond the institution would also be a factor. Collective library bodies such as RLUK (https://www.rluk.ac.uk/) or SCONUL (https://www.sconul.ac.uk/) would have a hand in shaping how the sector as a whole responded to AI. There seems to be an aspect of sector fashion in how technologies are adopted,

for example, in RDM there appears to be strong sectoral patterns in what is regarded as a mature service (Cox, Gadd, et al., 2019; Cox, Kennan, et al., 2019; Cox, Pinfield, & Rutter, 2019). In such collective forums the work of early adopters is made visible and this helps make the case in other institutions to emulate the example. Commercial organizations might be seeking to develop AI products for the sector, so their strategies would have some impact. Organizations like library schools might have an autonomous role in influencing the skills base of new entrants, thus enabling some strategies of adoption. Thus, as we look outwards into the wider social worlds within which the library sits, we can see a complex play of forces, within which the competition between professions at the workplace level and competing logics work themselves through.

8 | CONCLUSIONS

The paper started by reflecting on the Susskind's (2015) pessimism about the future of professions in the medium-term future. The application of AI that has been examined in depth here will in all likelihood take quite a lot longer to play out. The current analysis is largely based on the logic of theory, with empirical data being lacking due to the low current adoption of AI. However, based on logic and analogous responses to the RDM agenda we can expect the library profession to adopt many of the approaches described in the paper as it responds to the unfolding agenda. Some of the approaches suggest a threat to professional jobs, but perhaps more through the need to save money because of the cost of AI than because automation can replace the professional. The response to the earlier wave of "big data" (on which AI development is often premised) has arguably been quite dynamic. It might be considered fair to be optimistic, therefore, that librarianship will adapt, even be strengthened through this process. The limiting factor, perhaps, is that as a profession whose status remains linked to the status of the printed word the growing relative importance of quantitative data (as anticipated by McKinsey Global Institute, 2018) could be increasingly problematic for librarianship.

An analysis based on competencies gives us some sense of the types of skill that will be needed with different scenarios of AI use. This contributes significantly to an assessment of how likely each scenario is. This is also useful from a workforce planning or curriculum development perspective. An analysis rooted in the theory of the professions, incorporating an understanding of the hybrid position of librarianship takes us further in thinking through the underlying logics at work. This helps us understand some of the key drivers shaping responses, being a balancing of professional jurisdiction and management logics. One contribution of the paper is to explore the use of the two conceptual approaches together. However, it is hard to predict the outcome because AI is itself multiple and dynamic, and there are many external factors bearing on library responses, some of which have been identified here. Thinking about the future of the profession also needs to consider that AI is just one of a number of technologies that could impact it.

While this paper has concerned itself with AI, the analysis of hybridity between the logic of profession and managerialism could be applied to consider any area of academic library work and changes in it. There seems to be evidence that the perception of value in professionalism in librarianship has been eroded, such as the increasing employment of staff in library without LIS qualifications. However, the hybrid position, resting on the logic of the profession and of managerialism is a strong one, compared, for example, to that of other support services in universities which rarely have the same strength of professional grounding. The balancing conflicting logics seem to have a lot of explanatory power in understanding what drives decision making and conflict in academic librarianship. Therefore, a major contribution of the paper has been to bring in current thinking in the theory of the professions to analyze the evolution of academic librarianship.

As a conceptual piece this paper needs to be followed-up by empirical work to confirm how the analysis plays out in detail at the level of practice and within discourses around the profession as a whole. Much of the analysis drew on the author's relative familiarity with the UK library scene. These processes might well look radically different in other contexts: US academic libraries are both wealthier and perhaps stronger professionally. In contrast in Europe credentialization is less developed. Thus, further research is also needed to consider how the logics analyzed might play out in other geographies and contexts.

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