Embedding Accessibility in Research Support and Scholarly Communication Systems and Processes: A Reflective Case Study.

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Accessibility | Digital Content | Institutional Repository | Data Repository | Open Journals | Developer Tools | Inclusive Practices | Higher Education

Abbreviations
ANDI: Accessible Name and Description Inspector
DOI: Digital Object Identifier
FAIR: Findable, Accessible, Interoperable, Reproducible
HTML: Hyper Text Markup Language
IT: Information Technology
KAR: Kent Academic Repository
KDR: Kent Data Repository
MS: Microsoft
NVDA: Non-Visual Desktop Access
OA: Open Access
OCR: Optical Character Recognition
OJS: Open Journal System
OPERA: Opportunity, Productivity, Engagement, Reducing barriers, Achievement
PDF: Portable Digital File
PKP: Public Knowledge Project
UK: United Kingdom
VLE: Virtual Learning Environment
VPAT: Voluntary Product Accessibility Template
WAVE: Web Accessibility Evaluation Tool

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What This Paper Adds: In the context of the Public Sector Bodies (Websites and Mobile Applications) Accessibility Regulations (UK Government, 2018) this reflective case study examines the improvements we are making to accessibility across our research systems. We share our methodologies and break down the steps we are taking to embed inclusive

practices. We explore how these steps went and what we have learnt from the process. We are committed to future digital content accessibility in research and scholarly communication at the University of Kent and this project shows how it can be achieved using existing resources and be applied to other situations.

Introduction: The University of Kent is a multidisciplinary, teaching and research institution, serving 18,865 students across six academic divisions:

- Arts and Humanities
- Computing, Engineering and Mathematical Sciences
- Human and Social Science
- Kent Business School
- Law, Society and Social Justice
- Natural Sciences

Information Services, one of many professional service departments at the university, provides a broad range of library and Information Technology (IT) support, including two libraries containing 1.1 million books and journals, thousands of eBooks, eJournals and databases.

The Research and Scholarly Communication Support Team provides digital content and expert services throughout the research project lifecycle by:

- Supporting applications to secure funding for research projects by planning where, when, how and with whom research findings will be shared (University of Kent, 2021a), and planning how to organise, secure and archive research data (University of Kent, 2022a).
- Enabling Open Access (University of Kent, 2021b) publishing, providing guidance on where and how to publish the outcomes of research, how to manage copyright and how to licence research works for use, reuse and sharing (University of Kent, 2021c).
- Looking after and advocating for key online systems that support research at the University of Kent including our Kent Academic Repository (KAR) (University of Kent, 2022b), Kent Data Repository (KDR) (University of Kent, 2021d), and Open Journal System (OJS) (University of Kent, 2021e).

Kent Academic Repository is a repository and archive of research outputs, Kent Data Repository is an archive of research data and OJS is a platform for publishing our own university journals. They are used worldwide to access University of Kent research works.

Equality, Diversity, and Inclusivity at The University of Kent

We are committed to embedding equal and inclusive practices across the digital content and services we offer. We have benefitted from the expertise of the 'Opportunity, Productivity, Engagement, Reducing barriers, Achievement' (OPERA) team (University of Kent, 2020a), who are based within Student Support and Wellbeing, to enable us to respond to the Public Sector Bodies (Websites and Mobile Applications) Accessibility Regulations (2018) (UK Government, 2018), which places responsibility on United Kingdom (UK) public sector organisations, including universities, to provide accessible digital

content that can be used and understood by everyone. This means removing barriers that create unnecessary disadvantages for people with disabilities that are interacting with our digital content and services.
The term ‘accessible’ means different things in different contexts. For example, Open Access (OA) is a longstanding concept which relates to free access to information and unrestricted use of scholarly content for everyone (Budapest Open Access Initiative, 2022). This means, an article can be described as accessible in that it is openly available, but it is not necessarily readable for users of assistive technology. We need to communicate the meaning of digital accessibility as a way of formatting text, images, video, audio, and other works that ensures they can be meaningfully engaged with by those who rely on alternative formats, such as braille and text to speech software.

We also need to put this understanding of accessibility into practice. This means formatting our digital content to maximise its accessibility, including:

- Navigable headings and subheadings
- Alternative text descriptions of images that can be read aloud.
- Meaningful hyperlinks that describe where the reader will go when they click on a link to an external website.
- Transcripts and captions for audio visual content.
- Contrast that increases definition between the background and foreground.
- Minimum size 14 font in selectable text that can be copied and pasted.
- Header rows on tables to improve user navigation.
- Numbered pages, especially for long documents.

We needed to apply these practices to the systems that we support and their existing content.

Case Study Project: To gather evidence about accessibility barriers we separated potential issues into system platforms versus content. For example, colour contrast and keyboard navigation were identified as platform issues, while navigable headings and alternative text for images in documents were content issues.

The OPERA team assessed the accessibility of the platforms, reported several issues, and set a benchmark for our improvement work.

A notable challenge was that our systems contain many files created by private sector third parties. They have no legal obligation to create fully accessible digital content e.g., Portable Digital Files (PDF) of journal articles produced by commercial publishers.

We began by taking data samples from our systems: KAR (University of Kent, 2022b), KDR (University of Kent, 2022c) and OJS (University of Kent, 2021e). Using the tool Blackboard Ally (Blackboard Inc, 2022) we analysed the data samples and produced reports of the accessibility barriers.

The legislation required accessibility statements to be published for each system before September 2020. The

findings from Blackboard Ally (See Table 1 and Table 2 for examples) informed these statements (University of Kent, 2021f).

Accessibility Barriers Detected Across all 463 Documents in the Open Journal System	Number of Occurrences
Untagged	308
No language set	306
Missing a title	149
Missing headings	91
Contrast issues	42
Images without a description	32
Scanned but not OCRed*	8

Table 1: Accessibility barriers detected across all 463 documents in the Open Journal System. *OCR, Optical Character Recognition

Accessibility Barriers Detected Across a Sample of Documents in the Kent Academic Repository	Number of Occurrences
No language set	667
Missing a title	615
Contrast issues	268
Images without a description	14
Tables without any headers	10
Missing headings	8
Corrupted file that cannot be opened	3

Table 2: Accessibility barriers detected across 703 documents, 5% of the documents deposited to the Kent Academic Repository, between 1 September 2018 and 31 August 2020.

We then divided up the required work into packages:

1. Developing technical improvements to our systems software.
2. Devising and recording processes to make our systems more accessible.
3. Training all Research and Scholarly Communication staff, to format documents to maximise their accessibility, and writing guidance about how to do this.
4. Advocacy and collaboration.

While we encountered some difficulty initially with multiple conversations across teams, we got things running more smoothly by using a light touch project management approach. We listed issues and solutions in an Excel chart and grouped them into separate work packages. This allowed us to prioritise, assess the difficulties and decide upon short and longer-term objectives, while still capturing ideas for further development. It also ensured that we incorporated expertise from a range of perspectives and across specialisms, with colleagues assuming responsibility for different tasks.

Upon the completion of a work package, we made sure we reflected and marked our achievement. We published a blog at each stage, to share learning and experiences, and to document our progress and incremental improvements: Accessibility and Inclusion News (Caplehorne, 2020), Developing our ePrints Institutional Repository (Duffy, 2021), Technical improvements to our institutional and data repositories (Green-Hughes, 2021), and Accessibility requests (Caplehorne, 2021).

1. Developing Technical Improvements to Our Repository Systems Software

Both KAR (University of Kent, 2022b) and KDR (University of Kent, 2022c) are long standing systems and needed work to improve accessibility. As work was being done, regular automated testing took place to ensure that accessibility levels were improving. We used several software tools to automate the testing. An advantage of automating tests is that we can run the same tests as many times as we need to without any risks to our human testers and reducing the risk of testers becoming bored or inattentive.

Our repository systems are based on EPrints software (University of Southampton, 2022), with a mixture of third-party plugins, in house modifications and styling added. The software is open source which means that people can modify it and contribute changes back to a community of users so that everyone can benefit from that work. As a result, many people have contributed to the codebase for the repositories. This means we can access and edit the source code, to make the repositories more accessible.

We reviewed each system component that generated any output to ensure that:

- Keyboard navigation worked as expected, e.g., when pressing the tab key in a menu, the next menu item was highlighted. It was also necessary to make sure that all elements in the page were only reachable through keyboard navigation.
- Elements were correctly labelled and announced by screen readers properly, e.g., a navigation button should be labelled as such to make its purpose clear.
- Hypertext Mark-up Language (HTML) tables used for presentation were removed so that screen readers could navigate the page properly. HTML tables were commonly used to lay out pages, but screen readers see them as being there to represent tables of information. Screen readers may struggle to represent the layout of a page if HTML tables have been used inappropriately.
- Colour combinations used on the site were of high enough contrast to not cause any problems for people with colour vision deficiency.
- Both consuming and creating functionality were equally as accessible. Users of assistive technology should be able to use the system just as easily when creating or editing records, as when they use the system to look for information.

Continuous testing was used throughout to assess how successful the changes had been. Tools such as Lighthouse (Chrome Developers, 2022), which is built into Google Chrome, and WAVE (Utah State University, 2001) generated prioritised lists of outstanding issues. During the process of making a site more accessible, this list should reduce in size every time the tests are run.

EPrints Services, the commercial company that provides support services for its customers, has incorporated a lot of new accessibility developments into a forthcoming version of the platform software. Although we cannot upgrade to this version, these changes were incorporated into our source code by

modifying them to work with the version of EPrints we use.

We made further changes to meet the goals above and used a range of software tools to support this work. Many software tools are freely available to assist in making websites more accessible which means there is no need for expensive specialist software. Different tools excel in different ways, so using several tools in combination was a useful way to discover and resolve issues.

Keyboard navigation issues were isolated by using the ANDI bookmarklet (Social Security Administration, n.d.). This utility will generate a list of issues with elements that will not be announced by screen readers correctly. It will also show the keyboard navigation by letting you navigate through the screen and showing the label that would be announced.

The Accessibility Tab (Mozilla, 1998) in Mozilla Firefox was also used as it can display a representation of the web page with the tab order shown so you can compare it to expectations. Checks were also made by using the N.V.D.M. screenreader (NV Access Ltd, 2022) and listening to its output to see if it matches what is on the screen.

The Lighthouse tests showed a few colour contrast issues. These were solved by using the Colour Contrast Analyser (Vispero, 2022) tool to generate adjusted colour schemes, which looked like the original but did not cause problems for people with colour vision deficiency.

In the future, it would be great to do more manual testing with end users. Automated testing is very useful for making sure that known bugs are solved and stay solved. Manual testing can be useful for finding new issues, as human users may use the web site in different ways or do things that were unforeseen during development. They can also offer invaluable insight into the overall experience of using a web site.

Accessibility will now form a regular strand of work in the development of our institutional repositories. A continuous improvement approach will be taken to ensure that our systems are usable by all.

2. Devising and Recording Processes to Make Our Systems More Accessible

Kent Academic Repository (KAR)

The KAR (University of Kent, 2022b) provides an official record of research works produced by members of staff at the University of Kent. These records consist of bibliographic metadata that describe the work and the full text of the work itself. KAR contains over 62,000 documents and files, and this number continues to grow. They can be accessed by anyone at any time, but we had no system in place to respond to requests for accessibly formatted versions of these research works, only to download the original version (Figure 1).

Our aim was to enable users to request accessibly formatted copies of research works, and a process to respond to these requests – which required system changes. We also needed to enable staff to respond to requests for accessibly formatted content.

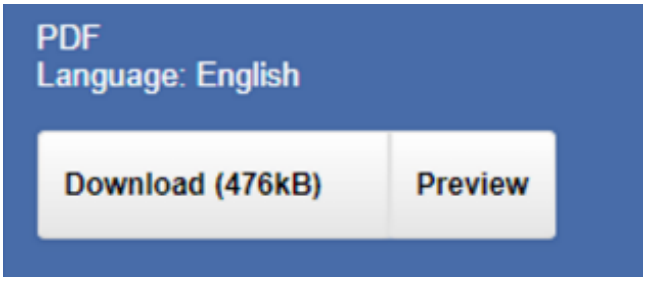

Figure 1: Screenshot of a section of a record from the Kent Academic Repository: Original download and preview options only before additional accessible copy options were available.

The first attempt to improve accessibility of the institutional repository was implementation of a **'Click to ask for an accessible copy'** button (Figure 2). This incorporated large and bold font to improve its noticeability.

When the feature was made live, we discovered that it had been highly observed, but not as intended. We received 64 requests in the first three weeks and realised that users were using the 'Click to ask for an accessible copy' button, rather than Download button that has always been used. If the requests were genuinely for accessibility reformatting, this would mean editing 64 different research works of varying size, content, and complexity, within one to two weeks.

Our limited resourcing meant that we could not meet this demand. Therefore, to enable us to prioritise our responses, we contacted each requester to confirm their requirements. This resulted in two people confirming that they needed an accessible copy. Some others explained that they had believed that they could request 'improvements' to the works available, or that we could change the outcomes of the research work. The majority wanted access to documents not available in KAR.

We then investigated other websites to inform improvements to the wording for the accessibility request button on our system. We chose "this file may not be suitable for users of assistive technology" (UK Government, n.d.), because it was clear and unambiguous.

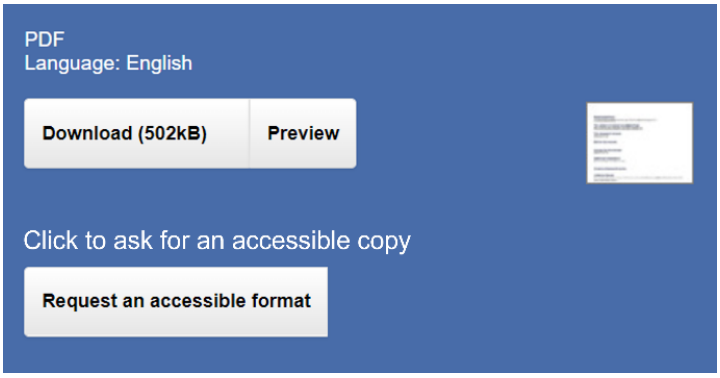

Figure 2: Screenshot of a section of a record from the Kent Academic Repository: First iteration of a button for user to request an accessible version of the research work.

Our developer revised the wording and font size (Figure 3), added text to 'submit request' to clarify the meaning of the request being made, and a 'return to previous page' to leave the request site. These changes appear to have improved the meaning of the term "accessible" in this context. We now receive an average of one accessible format request per month.

Figure 3: Screenshot of a section of a record from the Kent Academic Repository: Current iteration of the 'Request an accessible format' button. Includes the download and/or request options on a record from the Kent Academic Repository. It shows the button 'Request an accessible format'. It also shows the uploaded accessible copy with its Blackboard Ally score.

On receipt of a request, we export and convert the original file format to a word format (docx). Using a designated module in the Virtual Learning Environment (VLE) (University of Kent, 2021g), we upload the document, which automatically assesses the documents accessibility score using Blackboard Ally (Blackboard Inc, 2022).

We use the outcome from this process to start to make improvements. This typically involves manually adding formal heading structures, editing hyperlinks to make them meaningful, adding reading orders to tables, giving images alternative text descriptions, and other edits where necessary. If the changes prove beyond our capabilities, we contact our colleagues in the OPERA team.
When the reformatting is complete, we reupload the document to the VLE for a new accessibility score. If the document scores highly for accessibility, typically 98% or more, this copy is uploaded to the original record in the repository. It is labelled "Accessible Format" version, and we include the final Blackboard Ally accessibility score in the metadata. We also email a copy to the requestor to let them know that their request is complete.

We hope that we have now provided an easy and seamless way for people to request accessible versions of documents from the KAR. We took the lessons we learned from making KAR more accessible and applied them to our KDR.

Kent Data Repository (KDR)

KDR (University of Kent, 2021d) is a research data repository that preserves and provides open access to datasets, software, code, and other materials produced in the process of conducting research at the University of Kent. Research data underpins the publications and other outputs from research projects, and it is a distinct research output. Open access to read, download, and reuse research data is required by most major research funders, by publishers and by institutions like the University of Kent. If they are openly available data, methodologies and tools can be reused by other scholars thus increasing the citations and impact associated with the research projects.

Open data saves public money as investigations do not need to be repeated and funders see the best value from their grants. It also means less well-funded researchers, who can contribute valuable insights, can access raw materials for their work. More immediately, having the data associated with a project openly available means the research described in publications can be reproduced and validated as part of the peer review process, improving the reputation of the author and their home institution.

KDR uses the same platform software as KAR, and we applied the same changes to the platform as described in the KAR case study. However, we could not apply the same methodology to the files uploaded to the records. The files on KDR are divided into 3 main types:

Data files, README files and additional guidance:

- Data files can be audio, video, spreadsheet and database or text. They can also be specialist files for machine created information.
- README files exist to help users understand the data and they provide context and descriptions of the raw data files, including provenance, ethical context and methodologies used. Every record with uploaded data should have a README file in a txt file format.
- Additional materials could be in any file type but are usually text.

The variety of the data file types makes assessing accessibility difficult, but even assessing the README files and guidance files is not straightforward. KDR is managed according to FAIR data principles (GO FAIR, 2016). This means that research data on KDR should be:

- Findable
- Accessible
- Interoperable
- Re-usable

These principles overlap in many ways with accessibility requirements, for instance in that the language used should be clear and follow the rules of Plain English (University of Kent, 2021h). However, in some cases, these principles can obstruct accessibility. The interoperability clause means that we ask that files are uploaded in open or standard formats. For instance, .txt or .rtf file for text, csv for spreadsheets and jpegs for images, with no need for specialist or commercial software, and no hidden xml of java script. This means there is no restriction on users' ability to transform the data or adapt it for use with

other software, but the basic nature of open and standard file formats means they do not support the more advanced functionality of accessibility tools. For instance, text files do not support headings which makes the documents unstructured and difficult to follow when used with screen readers or Blackboard Ally. This means the README files and other documentation designed to improve understanding of the data, are explicitly required in a format that does not work with accessibility tools. With this complexity in mind, we did not apply the 'Request an accessible copy' button to KDR.

Moreover, the typical audience for data is limited to scholars and developers who want them to contribute to their own projects or applications and sometimes it is not possible to convert the files into open or standard file types. Users of these files will need to have specialist equipment and if they have accessibility issues, they are likely to be very specialist and as individuals they will have access to the equipment that they need to process the files.

However, we are open to requests to help with this using a universal help form. The general accessibility upgrade to the platform means that the help form is accessible and can be used to request different formats where required.

Open Journal System (OJS)

OJS (University of Kent, 2021e) is an open-source software for managing and publishing Open Access scholarly journals, used by academic researchers to publish articles, and was originally developed and released by the Public Knowledge Project at Simon Fraser University in Canada.

The University of Kent uses OJS to publish four Open Access scholarly journals: Advanced Journal of Professional Practice (University of Kent, 2022d), Feminists@law (University of Kent, 2022e), Kent Law Review (University of Kent, 2022f), and Transmotion (University of Kent, 2022g).

Unlike some traditional publishing models where authors pay to publish their research as articles, the university passes no costs to authors to publish their research in any of these scholarly journals. Readers can also access all research articles published across these journals without any cost to them. Our publishing ecosystem is one that supports and enables equal and fair opportunities for authors and readers across the globe to publish, read and reuse research.

Each published journal article is subject to traditional publishing processes that ensure their academic integrity such as:

- An editorial board of subject specialists and academic staff.
- Peer review to assess the quality and originality of submitted articles prior to their publication.
- A Digital Object Identifier (DOI) for each article to support online sharing of the research which helps maximise the reach and impact of the work.

Who is responsible for Open Journal System?	What areas of Open Journal System are they responsible for?
Public Knowledge Project	Technical support, platform upgrades and migration, accessibility of the platform, data exports, future system development.
Research and Scholarly Communication Support	Relationship management between all stakeholders, platform upgrades and migration, technical support to journal editors, installing plugins to enhance functionality for each journal, journal accessibility including developing training offers for editors and informing them about the changes to the law. Applications for new journals or transition of a journal from an existing publisher and the requirements of the application process.
Journal editors, chiefly academic staff members at the University of Kent.	At least two members of academic staff from the University of Kent are lead editors for each of the four journals and manage article submissions from authors, peer review of submissions, publishing, marketing, and accessibility of the published content.

Table 3: A summary of the core stakeholders that are responsible for the Open Journal System and what areas of responsibility are within their remit.

Responsibility for the Open Journal System is shared by multiple stakeholders as summarised in Table 3. Whilst relationship management and communication between all stakeholders is professional and positive, it is important for the Research and Scholarly Communication Support Team to consider the individual impacts of the extra responsibility of the editorial role. Academic editors of the four journals have teaching and research obligations at the University which means they have significant competing demands on their time, in addition to compliance and reporting requirements to their research funders, publishers, professional bodies and the university.

Now that editorial responsibility for their journals includes accessibility as a legal requirement, we are addressing the impact of this sensitively by developing resources and offering training.

Virtual meetings between Public Knowledge Project (Canada), and the University of Kent (UK), have taken place in the past. However, even before the normalisation of virtual meetings due to the Covid-19 pandemic, scheduling these according to our respective time zones and varying commitments is often a challenge. Therefore, most of our communications about accessibility have taken place over email which, while it can naturally cause things to take a little longer, has also enabled ease of process tracking.

Making improvements to OJS accessibility involves multiple processes, due to the number of stakeholders involved in developing and maintaining the overall platform and each of the editors who manage the individual journals. Members of our Research and Scholarly Communication support Team

currently manage these relationships, including liaising with accessibility specialists at the University of Kent, and are developing training and guidance to widen participation of the team in managing the OJS.

We assessed accessibility of the OJS platform and content separately because of how responsibility for each of these is shared by the different stakeholders. We also asked Public Knowledge Project if they have published an accessibility statement for the platform. In Canada these are referred to as Voluntary Product Accessibility Statements (VPAT). In August 2020, Public Knowledge Project shared their plans to make Default Themes (PKP, n.d.) accessible for release in 2021, with a second audit planned to adjust any remaining accessibility issues later in the year.

They confirmed that the VPAT would be generated after this work to outline the level of compliance and future work that may be needed. Whilst with the repositories we can make changes to the top-level code, the OJS platform is completely hosted, and we do not have access to any of the platform code.

At the same time, we asked for a full data export from OJS of all the articles published in PDF by each of the journals. Two of the four journals include additional document formats that are published simultaneously to the PDF; one journal publishes an additional HTML version whilst the other publishes HTML and Word versions. We did not test these versions for accessibility because we wanted to understand the barriers that prevents accessibility using a format shared by all the journals.

Our testing showed us that only 24% of article content is published accessibly (Table 2). This means that improvements need to be made to existing content and all future content. We started by working with an external agency, Codemantra, to trial converting the content of the Advanced Journal of Professional Practice and maximise its accessibility. This trial has been highly successful, so we will explore rolling this out to our remaining journals.

Whilst this has the power to be transformational, we are exploring alternative options to improve accessibility where the long-term cost may not be sustainable, this includes developing accessible journal article templates that we will share with the publishing community to improve accessibility beyond our publishing offer.

Whilst there is enthusiasm from our editors to embed accessibility across all the journals there is concern from some that the appearance of an accessibly formatted journal article will undermine the professional integrity of the work. This is a sector wide issue for small publishers who are competing for authors and content with large prestigious corporate publishers. The need for accessibility requirements makes some editors feel that they are disadvantaged where the large international publishers do not have this pressure.

We are working closely with our journal editors to balance their needs. However, we will also promote how being a pioneer of applying accessibility to scholarly digital

content could be beneficial for the reputation of the journal, their professional profile as a lead editor, and for all consumers of the digital content they produce. We can now use the success of the Advanced Journal of Professional Practice as a showcase for this.

To support our editors to maximise the accessibility of their journals, training is now offered and can be provided by the University's OPERA Team. The training covers the legal requirements of the accessibility legislation, the importance of accessibility and inclusive practices, and practical support to create accessible content. Born-accessible content is easier to achieve than retrospective improvements once the layout and content of the article is finalised. Embedding accessibility from the outset by authors saves time and resources as they are best placed to provide image descriptions, plain English alternatives, and data labels.

When a prospective editorial team are making an application to host a new journal with the University of Kent, they must meet certain criteria which now includes providing fully accessible website and journal content. We implemented this in March 2018, ahead of the changes to UK law, to ensure equitable access for all to University of Kent published journals. If a new journal does not agree to meet these conditions, the journal proposal will be declined.

As a large research institution, the University of Kent has a responsibility to support the sustainable embedding of accessibility practices in scholarly publishing. Unlike the repositories, the OJS platform gives us the opportunity to demonstrate accessible practices throughout the publishing life cycle. We have complete control over the platform and its content through our journal policies and templates. It is therefore imperative that we use this to engender a culture that sees accessibility as business as usual.

3. Training Staff to Create Accessible Formats

A lack of practical guidance about how to make documents more accessible led us to develop our own training and resources to help our staff feel confident and equipped to respond to accessibility requests.

The University of Kent OPERA team hosted a one-off virtual training event for Research Support staff via Microsoft Teams. Having discussed why accessibility is beneficial for everyone and the changes to the law, the team were shown how to maximise accessibility of research works held in the repository, focussing chiefly on articles and presentations. Whilst this standalone event was an informative starting place, more guidance would be essential to empower staff to respond accessibility requests.

We have developed two fully accessible resources for staff, which are partly based on the guidance developed by the University's OPERA team, and have shared these via our team SharePoint site.

Table 4 display some of the topics covered in our guidance:

Creating accessible content topics	What these topics include
Why accessibility matters	*It's the right thing to do, it benefits everyone and it's the law.*
Formatting	*Document design and layout, font size and type, contrast, page numbering, and using a table of contents.*
Headings	*Formal style headings instead of using bold to highlight different sections, and table of contents.*
Bullets and numbered lists	*Formal bullet and numbered lists instead of manual numbering.*
Language and text	*Selectable text, Plain English, and meaningful link text.*
Images and logos	*Alternative text and how to write it, and decorative images and logos.*
Scientific and mathematical formulas	*Remediation of PDFs containing mathematical equations and symbols using the tool Equatio* (Texthelp, 2022), *replacing symbols.*
Table structures	*Header rows, reading order, split cells, merged cells and nested tables.*
Presentations	*Standard templates, layout, font, design, contrast, transitions and animations, embedding video, transcripts, and notes fields.*
Portable Document Formats (PDF)	*Converting a PDF, checking accessibility of source documents, web page conversions, and Google drive users.*
Excel spreadsheets	*Alternative text for visuals, meaningful hyperlink text and ScreenTips, worksheet naming, colour and contrast, structures and headers.*
Emails	*Accessibility settings, font size and type, contrast, built in headings and styles, built in bullets and numbered lists, meaningful link text, alternative image descriptions and table structures.*
Testing documents accessibility	*Using Microsoft Accessibility Checker* (Microsoft, n.d.) *and Blackboard Ally* (Blackboard Inc, 2022).

Table 4: Topics that we included in our creating accessible content guides.

The guidance will be adapted and improved over time. For example, the section about scientific and mathematical formula were added retrospectively, and with a lot of support from the OPERA team, due to challenges we faced when editing a journal article that included Greek mathematical symbols in the equations. This has been the most challenging aspect of formatting documents to maximise their accessibility.

Scientific and mathematical equations are specific to their disciplines which means that specialist understanding is needed to ensure the reformatting reflects the original. Similarly, none of our team members can be expert in every academic area so even with humanities and arts works we can struggle with some of the adjustments.

The Advanced Journal of Professional Practice has further demonstrated its commitment to equal and inclusive publishing practice by sharing accessibility guidelines for submitting authors on its website.

4. Advocacy and Collaboration

Accessibility is not just a set of requirements but a developing field of study and in recent years staff from across the different departments have embraced this ethos by:

- Working together to share expertise.
- Sharing our experiences with the wider sector.
- Attending conferences and networking with the wider sector.
- Engaging with external stakeholders.

One side effect of the Covid 19 pandemic is that many conferences have been forced online so attending events has been much easier for speakers and delegates and are a useful way to pick up extra skills, learn about new technologies, and to network with other knowledgeable people.

In 2019 team members presented at the British Library's 'Open and Engaged' conference where they discussed the power of open and fully accessible research works (Watson & Caplehorne, 2019). They were invited back a year later where they discussed how the 'Public Sector Bodies (Websites and Mobile Applications) Accessibility Regulations' (UK Government, 2018) are impacting the work of public sector bodies, and what more could be done to place responsibility on the private sector to create accessible content at point of creation (Caplehorne & Watson, 2020).

There is evidence that the sector is embracing accessibility, which we have observed through the number of sector wide professionals engaging with of our own accessibility and inclusion news blogs who have also asked to speak with us. However, enthusiasm has not always been shared by those with the power and influence to make real change. We were disappointed when we learned that, after advocating for an accessibility ally from a well-known and respected research funder, that they didn't consider accessibility of published research works to be a priority. This was incredibly frustrating, as accessibility is easy to achieve and the right thing to do. However, it demonstrates that a shift in attitude and change in culture at the very top is needed to deliver the changes in legislation and fully realise the universal potential of accessibility.
This is the reason why we will continue to act as accessibility and inclusion champions across our sectors by sharing best practice and advocating for change.

We used an informal working group as a project team to review documents and to decide upon next steps. A more formal Accessibility and Inclusion Working Group (Research Support) considers wider issues. This pulls in expertise from across the university. Its membership includes representatives from Student Support, User Experience and Marketing, IT, and Library and we also plan to include student ambassadors.

Next Steps

We are acutely aware that, despite our achievements to date, our work to remove barriers to enable equal access for everyone is ongoing. In addition to continuing to advocate and collaborate across the scholarly community we are seeking to prioritise several developments:

- **Coversheets:** these are used in our KAR and are automatically generated by the system and added before the first page of the full text output. They include a summary of the publication information, citation format and links to external sources. A coversheet also gives a clear indication of where the full text is held which is helpful to readers who have discovered the output via an internet search.

  They are not yet in an accessible format and although we are aiming for this there are several technical challenges that we need to overcome. For example:

  - Creation of the PDF for the coversheet uses different software for creating the PDF for the article. The two must be 'stitched' together to appear as one seamless document.
  - How we structure the coversheet to make them navigable so that it fits with the structure of the rest of the document.
  - Fields on the coversheet are populated from metadata in the KAR record. However, metadata is often not produced in accessible formats. A good example is a DOI which is included in the metadata as a raw hyperlink (e.g., doi:10.[nnnnnn/nnnn]).

  We will also use this as an opportunity to include more information such as licences that explain how the research work can be used and reused, and the version of the work.

- **Practice-based research works:** these result from research created in the process of practice, for instance performance, artwork, clinical development, engineering design and prototype development. They are created in multiple formats and separately to other research works. This means they require specialist description, preservation, and discovery (Cooper & Caplehorne, 2019).

  During a project in 2018 we researched best practice approaches in supporting practice-based research works (Edwards, *et al*., 2018). Our next steps for incorporating accessibility with the outcomes of this project are:

  - Seeking advice and guidance on writing alternative descriptions for practice-based research works, particularly where a work is open to artistic interpretation.
  - Developing our knowledge about the range of formats practice-based research can be created in and any alternative formats that can be used to maximise its accessibility.
  - Reviewing all future procurement of systems and products that support practice-based research for accessibility.

  We are continuing to work with other universities to ensure research support infrastructure reflects the needs of practice-based researchers and researchers in the arts. This includes contributing to work to identify more inclusive roles in research.

- **Theses:** produced by Master and Doctoral research students at the end of their studies, thesis can be large documents that contain text, diagrams, images, tables, scientific formulas, and

other content. The style and formatting of the templates used by the schools varies considerably. Different reference styles (University of Kent, 2020b) are used according to the academic discipline. All this creates accessibility barriers that will be challenging to address because style format and standard referencing styles underpin the perceived academic integrity of the output.

Academic and professional services staff within the Schools at the University are responsible for supervising students to author their thesis and upload them to the VLE, from where they are automatically uploaded to KAR, and thence made available to be downloaded.
Our ambition is that all these are published to KAR as fully accessible documents and that the students are supported to do this beyond the current training offer. This will need to be project managed, due to the interdisciplinary collaboration required between Information Services, Graduate and Researcher College, Student Support and Wellbeing, the Divisions and the Schools, and the Executive Group.

The project will aim to provide:

- An understanding of the legal requirement to create accessible digital content.
- An understanding of the ethics of providing accessible content.
- Accessible thesis templates to each of the Divisions for their students.
- Practical training events and online guidance about creating accessible content.
- Online spaces to test thesis document accessibility prior to upload to the VLE.
- An understanding of the challenges involved, from accessibility of mathematical equations, to handling inaccessible content after an authoring student leaves the university.

By implementing practical resources and guidance in this way we hope to:

- Publish all future theses as fully accessible.
- Create transparency by sharing accessibility scores of the theses we produce.
- Create accessibility champion students, academic and professional staff.

- **Future development of the KAR:** Researchers create data management plans at the beginning of a project. They detail how the data will be created, processed, stored, archived, and shared. We are looking at how we can ensure that these plans are created with accessibility in mind and include consideration of how data are accessible to all people. This requires advocacy and guidance to include accessibility as a built-in characteristic.

- **User experience:** The arrival of the new regulations has brought a welcome focus on improving sites for users of assistive technology. While complying with the regulations would be a wonderful start, it is important to remember that this work is about people not just regulations. In the future we would like to incorporate feedback from assistive technology users directly in our planning and development. We would also like to incorporate user

stories into our planning as this would help us better evaluate the impact of our choices on marginalised groups.

Lessons Learned

This project included input from teams across our large Information Services Department and Student Services. It required changes to systems, procedures, and web pages in several different areas at once, while we were also developing whole new processes. The project was conceived at an operational level and did not benefit from the formal project management structure available to strategic management developments. This led to a fragmented approach which was exacerbated by the necessity for remote online working during Covid-19 pandemic, and the looming deadline for the accessibility statements.

Fortunately, all the staff involved were enthusiastic and keen to ensure the work was done in a way that would help our users and meet the legislative demands.

Challenges included:

- Lack of coordination about objectives and definitions – did we need to have the services in place or was a stated intention to change enough?
- Differing interpretations of what needed to be accomplished when and by whom.
- Questions about who to include and at what stage.

Implementing light-touch project management techniques during the project did help align objectives and timescales, as did use of MS Teams in communicating and sharing documents. But the main catalyst was a renewed willingness to communicate and share decision making among the team.

Our experience with improving accessibility within our institutional repository taught us the importance of being explicit about what is meant by the term “accessible”. Context is vital in conveying meaning. In the environment of scholarly communication and open research service, “accessible” might mean “open access” or simply “obtainable” even in the sense of acquiring data or information that had not been flagged as even existing. In the context of the topic of this article “accessible” means possessing qualities and in a format that enables the use of assistive technology. We need to make it include all those meanings in one so accessible content is free to access, easy to obtain and use by anyone.

We recognised that approaches and solutions need to be bespoke with allowances and adaptations required for different systems. For example, our research data repository, KDR, presented issues not shared by our publication repository, KAR. Because long-term preservation and re-use are objectives of KDR, our preference is for data to be archived in their simplest, non-proprietary form but these do not facilitate accessibility e.g., there is no heading structure or hierarchy in a text file. Further, the external audience and users of KDR are typically scholars and developers who want the original data to contribute to their own projects or applications. They tend to have specialised equipment for using and producing research data, so the general approach that we can apply to largely text-

based documents in our publication's repository, KAR, is not applicable.

Throughout the course of our improvement work we developed a mental checklist of things to be aware of. These include:

- There is a dearth of practical guidance on converting documents into accessible formats. Time is needed to create this guidance and/or adapt what does exist to suit local situations.
- Accessibility testing tools do not and cannot provide an overview on using a whole system or site from the perspective of a user with accessibility requirements.

As a public sector organisation, it is our responsibility to ensure that all content in our repositories is accessible. This includes research works published by external private sector publishers who do not have any legal obligation to create fully accessible digital content.

In an ideal world we would already be providing immediate accessible research works from the institutional repository. However, thousands of research works are deposited to the repository every year (see Figure 4) that require checking for their bibliographic description accuracy and multiple other criteria. A crucial decision was therefore whether we could commit to reviewing and amending all new content added from 2020 onwards to provide accessible versions of works on our systems. Even without the ongoing uncertainty of departmental restructure, we considered that the staffing resource required to produce accessible versions of all new deposits would be considerable.

We also discussed asking authors to provide us with accessible copies of their research work. It would ensure accurate alternative text descriptions of images that require additional context and specialist understanding and would provide an immediately accessible copy of the work when deposited to the repository. However, scholarly authors are already meeting the document formatting demands of their publishers and are under huge time and work pressures to balance teaching and research. The latter has been exacerbated by the Covid-19 pandemic which has placed additional pressures on academics to transition to virtual teaching for the first time and, for those with parent and caring responsibilities the pandemic has caused further disadvantages due to increased home-schooling responsibilities (Chung, *et al*., 2021).Our decision was to develop a reliable on-demand service to fulfil requests for accessible versions of works from our systems. This means that we are confident that this service is sustainable in the long-term and as newly converted documents are added back onto our repositories, we are incrementally increasing the percentage of content that meets accessibility standards. It also ensures that we have capacity for wider training and advocacy, as well as to pursue our objectives to improve the situation at source, for example encouraging our own PhD students and supervisors to create university theses in an accessible form. We will continue to lobby for legal changes that would mean private publishers are as equally accountable as the public sector for providing accessible digital content.

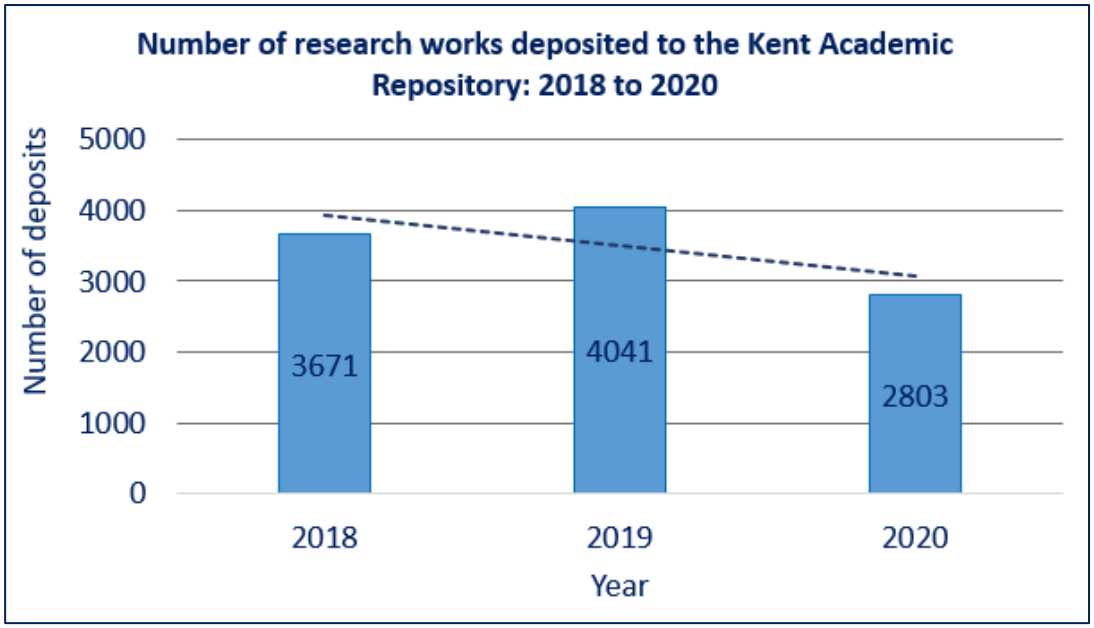

Figure 4: Bar graph demonstrates the total number of research works deposited to the Kent Academic Repository between January 1st 2018 and December 31st 2020. The overall projection for future deposits is currently showing a decline. However, we know that the Covid-19 pandemic has had a substantial impact on research, particularly where field work has been required. We expect that the projection for deposits to the repository will increase from 2022 as research that paused during, or has had a delayed start due to Covid-19, will start to get underway.

A tension exists between the perceptions of traditional publishing practices as a marker of professional integrity versus accessibility as a legal, professional requirement. While UK law now requires public sector bodies to create and publish accessible content, this is not a requirement for private companies, including publishers. Accessible formats of research publications risk being judged as "basic" or "over-simplified" and lacking academic weight or expertise because of their appearance, even though the content is identical to that of the scholarly version using a traditional academic style. We encountered this in our case study of OJS and predict it will be an obstacle in our plans to improve accessibility of university theses.

Until the law requires private companies, including publishers, to address accessibility in the same way that the public sector has, then tensions between academic integrity and accessibility will persist. An intermediate, pragmatic solution is to focus on encouraging the production of two versions of each academic work.

As with all change, accessibility must become a natural part of everyday behaviour. Covid-19 has demonstrated the value of quick and easy access to reliable, quality scholarly resources. As the internet and virtual world is now integral to all working lives, research and study, the volume of scholarly material is only going to increase. Therefore, it is imperative that our systems, and content are accessible to all.

While the recent accessibility legislation initially felt like a huge and daunting task to remedy existing systems and large amounts of content, we did manage to

meet that challenge by applying an incremental, scalable, and pragmatic approach. These studies have shown us that accessibility is possible and achievable but must become a permanent feature of working practices and attitudes. The introduction of the legislation has increased the priority of accessibility within the University of Kent, but the challenge is to keep it there.

Conclusion: Having described the situations and the approaches we took, the issues we encountered and the findings we have identified fall into three categories:

- Those we were able to address and class as “lessons learned”.
- Those which we would recommend are kept in mind as awareness checkers.
- Those which we are less able to assert influence over which will require a long-term approach.

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