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Key Issues Affecting the Inclusion of Alt Text in Scholarly PDF Publications

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Abstract

Alternative (alt) text descriptions for images in digital publications provide comparable information for people who cannot effectively see the visuals. They are relied upon by people who are blind or who have a moderate to severe visual impairment and who use assistive technologies. However, consistent provision of alt text is proving challenging for publishers because of the required changes in workflow, budgeting, and resourcing; in particular, scholarly publications contain high numbers of images requiring alt text. Most industry knowledge-sharing and studies on alt text in scholarly PDFs focus on large and medium-sized publishers and high JIF titles. To explore key issues affecting the consistent inclusion of alt text in publications produced by small and non-profit publishers this study uses the case of a UK-based independent research organization. Drawing on PDF analyses and a focus group discussion with publishing staff, the article makes recommendations for similar organizations seeking to publish alt text.

Keywords

Alt text, accessible publishing, scholarly publishing, PDF, image description, print disabilities, screen reader, assistive technologies.

Author note

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1. Introduction

Scholarly publishing plays a key role in the communication and uptake of research findings, but scholarly publications can be challenging to read for people with print disabilities (Nganji, 2015; 2018; Rajkumar et al., 2020; Bigham et al., 2016). The term ‘print disabled’ comprises a far from homogeneous group, which includes “persons who cannot effectively read print because of a visual, physical, perceptual, developmental, cognitive, or learning disability” (DAISY Consortium, 2021b), and some definitions also include temporary or situational disability (EDiTEUR, 2013).

There are three main reasons why scholarly publications are especially challenging. First, complex research data and findings are often visualized—considerably more so than in trade publishing—to succinctly convey the data and reduce cognitive load (Splendiani and Ribera, 2016; Rolandi et al., 2011). It can be difficult, often impossible, for people with print disabilities who use assistive technologies to effectively read or access these images unless text alternatives are provided (Gauvreau, 2020; Alcaraz Martínez et al., 2022b). Second, the predominant publication format for scholarly publishing, PDF, can be inflexible and inaccessible if it has not been created with accessibility in mind (Turró, 2008; Sorge et al., 2020). Third, the scholarly publishing sector (together with other publishing sectors) has historically left the creation of accessible publications to third parties such as disability organizations (Orme, 2013). As a result, many scholarly publications are inaccessible to a proportion of their potential readership. These community-wide choices about format, visualization, and workflow create unintentional information inequalities and potential barriers to impact (Jung et al., 2021; Schimpf and Beddoes, 2021).

Publishers have started to actively produce accessible publications and to consider how accessibility can be embedded into their workflows. This change is attributable to a number of factors, which include: forthcoming legislation that requires ebooks to be accessible (European Parliament, 2019); strong advocacy from accessible publishing organizations and consortia (such as the DAISY Consortium,ⁱ Accessible

Books Consortium,ⁱⁱ and Inclusive Publishingⁱⁱⁱ); software developments and new standards, formats, and guidelines (World Wide Web Consortium [W3C], 2019b; Kasdorf, 2020); and increased awareness and acknowledgement of the ethical needs for accessible content.

Although there are many simple ways in which publishers can make their publications more accessible—such as font and color choices and using inbuilt functions in desktop processing software—there are also some more challenging elements, and the aspect that scholarly publishers cite as their biggest challenge is alternative (alt) text image description (Gies, 2018; DAISY Consortium, 2020c; Kasdorf, 2018). Alt text conveys information comparable to the visual for people who cannot effectively see it, and is therefore essential for people using screen readers and similar assistive technologies, particularly people who are blind or have a moderate to severe visual impairment.

For scholarly publishers whose products contain large numbers of complex images, the production of alt text is a significant addition to their established workflows. Much of the discussion about alt text workflows in the literature and in recent publishing sector knowledge-sharing has been from the perspective of large and medium-sized publishers (for example, Manis and Alexander, 2018; Gies et al., 2016; DAISY Consortium, 2020c); however, the workflows, solutions, and finances available to these organizations may not be appropriate or feasible for smaller publishers, especially non-profit publishers such as independent research organizations.

To explore the key issues affecting the inclusion of alt text in the publications produced by smaller scholarly publishers, this article presents the findings of a case study focusing on one independent non-profit research organization, the Institute of Development Studies (IDS), based at the University of Sussex, UK.^{iv} IDS publishes approximately 500 publications each year, most of which are in PDF format, ranging from the Institute's gold open access journal, the *IDS Bulletin*, to research reports, working papers, edited collections, shorter briefing papers and, from autumn 2022, ebooks. The study addressed the research questions: How does IDS currently include alt text in its digital publications, and how can it take steps to consistently integrate alt text in its publishing workflows in the future?

The IDS Publications Team has been exploring the accessibility of its outputs as part of its work on equality, diversity, and inclusion. IDS has a strong commitment to increasing **access to** research and knowledge; the Institute's default open access licence is the Creative Commons Attribution (CC BY) licence, and IDS research is freely available at the point of publication via the IDS OpenDocs repository.^v The Institute also champions digital rights and designs new digital technologies that increase access to online research assets. However, for a scholarly publication to be truly **accessible** it must also be published in a format that people with print disabilities can interact with effectively, and be written, produced, and distributed with accessibility in mind.

This article largely focuses on PDF publishing; however, the introduction to alt text, literature review, and key issues section also discuss accessibility and alt text in relation to EPUB and HTML production. Recommendations drawn from the case study may be relevant for other research organizations and small scholarly publishers seeking to include alt text in their PDF publications. The article is structured as follows. The next section introduces alt text and its use in scholarly publishing. Section three explores the key issues affecting alt text and accessibility. Section four positions the study within the existing literature. Section five presents the methodologies adopted and the research findings. Section six concludes and presents recommendations for how small scholarly publishers can take steps to include alt text in their workflows.

2. What is alt text, and how is it used in scholarly publishing?

2.1 What is alt text?

Alt text is a concise description of a digital image. Its main purpose is to make the image accessible to people with visual disabilities, particularly people who are blind or have a moderate to severe visual impairment (DIAGRAM [Digital Image and Graphic Resources for Accessible Materials] Center, 2015). Combined, these two groups constitute approximately four per cent of the world's population,^{vi} many of whom rely on screen readers and assistive technologies to read online content and publications (AbilityNet, 2021b). The presence of alt text is essential for these users because a screen reader will pass over an image unless alt text is provided (DAISY Consortium, 2020c). Where an image contains alt text, the software reads the

description aloud or renders it in another form such as Braille. Box 1 provides further information about screen readers and their technical requirements for alt text.

Box 1. How screen readers render alt text

Screen reader software is used by people who are blind or have a visual impairment, in order to access and interact with content on devices such as computers, tablets, and mobile phones. The software can be downloaded on to the device, the most popular being JAWS (Job Access With Speech) and NVDA (NonVisual Desktop Access). Some devices feature screen reader applications as standard, such as Microsoft's Narrator and Apple's VoiceOver.

Alt text is embedded in an image and does not appear to other readers. When the screen reader reaches an image, the software reads the alt text in a section of 125 characters, stopping once it reaches this limit. Some screen readers will allow the user to listen to a further 125 characters before moving on to the next content element, but this is not a universal feature. Best practice guidance on alt text recommends that it should ideally be less than 125 characters but no more than 250.

Sources: GOV.UK, 2016; WebAIM, 2021; DAISY Consortium, 2020a; 2020b.

Alt text is not the same as an image heading, caption, or source line, which provide background information about the image or the ownership of its underlying data. Instead it focuses on the meaning and purpose of the image, supplying the user with a description that is comparable to the visual (Manocha et al., n.d.; DAISY Consortium, 2020c; W3C, 2021d; Hilderley, 2013). This can range from describing the important information shown in a photograph to listing the statistics and trends in a line graph. Too often, however, screen reader users encounter non-descriptive alt text that repeats the heading or caption, or simply the number of the image, for example 'Figure 1' (Jung et al., 2021; Kasdorf, 2019). Readers relying on alt text to interpret an image may be unable to access the information without seeking help and, left frustrated, may move on to another webpage or publication (Gauvreau, 2020).

Despite this, there are surprisingly few definitions of what constitutes 'meaningful' alt text. This is presumably because (as will be discussed below) the wide range of variables and types of images makes it hard to create a single, definitive list of

criteria. W3C has published guidance on types of images and their alt text requirements, including an alt text decision tree (W3C, 2019a). Accessible publishing-focused organizations have also developed practical guidelines and tools for people writing alt text, such as Benetech's DIAGRAM Center (2021). The DAISY Consortium's webinar series (DAISY Consortium, 2021a) also features four practical training webinars on describing images.

This article considers meaningful alt text from the following perspective: if the image were removed or could not be seen effectively, the reader would receive sufficient information from a combination of the alt text and the image's surrounding text to understand what it conveys and its purpose in the publication. In essence, the alt text provides comparable information to the image.

2.2 Background to alt text for web content and scholarly publications

Alt text is a 'success criterion' in meeting the Web Content Accessibility Guidelines (WCAG) 2.1 standard. The criterion—1.1.1 Non-text content—requires text alternatives for visual content so that the reader can access the image in the form that is most practical for them (W3C, 2021c, 2021d). Beyond accessibility, alt text has wider benefits for web content users and providers. Alt text displays on-screen if an image is not available, which benefits website users in countries and areas with expensive internet rates or slow connections, who may choose to turn off images (W3C, 2021a). Content providers who include alt text benefit from increased search engine optimization (SEO) and discoverability (de Valk, 2020).

The publication formats most produced by scholarly publishers have been developed over time to become increasingly accessible, drawing on the WCAG standards and adding publishing-specific criteria. For example, PDF, the focus of this article, has a range of accessibility features, including embedding alt text into images. Scholarly digital publications such as journal articles, ebooks, and grey literature feature a high volume of images, many of which aim to simplify complex data into an easily readable form (Rolandi et al., 2011). This introduces a tension between, on the one hand, communicating information in a user-friendly way and, on the other hand, the potential for creating information inequalities for people who cannot effectively see what is on the screen. Data-driven and evidence-based imagery is increasingly used for the purpose of effective communication of scholarly research (Henein and

Mathew, 2020; Ibrahim et al., 2017). How, then, can publishers and their communications colleagues ensure that information within these images is received equally? Alt text offers a solution.

2.3 When and how is alt text used to describe images in scholarly publications?

The alt text for an image is determined by both the type of image and how it is described in the surrounding text. Alt text is not required for all images, and it is important for publishers new to accessibility to understand when and how alt text is used before they incorporate it into publishing workflows.

The images in scholarly publications can be broadly categorized as ‘decorative’, ‘informative’, and ‘complex’ (Alcaraz Martínez, 2022a; W3C, 2019a; Rajkumar et al., 2020; DAISY Consortium, 2020b):

- **Decorative images** are either purely for decoration or do not provide the reader with any additional information. These images **do not** require alt text and can be marked as decorative by ticking a box in software such as Microsoft Word or assigning it as an artefact in Adobe InDesign. Examples include logos, borders, decorative photos, and, sometimes, images that are described fully within the text.
- **Informative images** present simple information that adds value to or supplements the text. Examples include simple text-based images, photographs, and very simple charts that can be sufficiently described in a short alt text description of 125–250 characters (see Box 1).
- **Complex images** contain text, data, or information that cannot be described in 125–250 characters. Examples include diagrams, charts, infographics, illustrations, and highly detailed photos. These images still require alt text, which will briefly introduce the image and signpost the reader to an additional, long description that details what the image communicates visually. The long description is often positioned below the image or in an annex. There is no set length for this text, but descriptions are kept as concise as possible.

The images most frequently used in scholarly publications are complex, requiring long descriptions and short alt text. While this may seem at odds with the purpose of using images to condense information into an easily digestible format, the inclusion of long descriptions of complex images can enhance comprehension and the experience for all readers.

The second consideration is whether and how the image is mentioned in the surrounding text. In most cases, images in scholarly publications accompany and supplement information discussed in the text, but, in practice, their mention in the text can be as short as a brief citation (e.g. ‘see Figure 1’) (Splendiani and Ribera, 2016). Describing each image’s content and purpose in the text is the best way for authors to maximize understanding for **all** readers. This is easiest for informative images, but often not possible for complex images— as in the case of trying to list data points per year for a chart. Before writing the description, therefore, an alt text writer reads around the image to ascertain how it has been discussed and where there may be information gaps (DIAGRAM Center, 2015). Neither the short alt text nor long description should be a verbatim repetition of information provided elsewhere in the text; instead, they fill the gaps or provide the whole picture to ensure that people unable to see the image effectively do receive comparable information. The description is structured logically so that the reader can visualize the image; alternatively, data can be presented in a table alongside the image.

Writing alt text requires a time and resource commitment, and the variety of possible images need to be assessed on a case-by-case basis. However, the provision of alt text is essential for people using screen reader technologies. The next section explores and evaluates the social, political and legal, technological, and organizational and financial issues affecting alt text and accessible publishing more broadly.

3. Key issues related to accessibility and alt text in scholarly publishing

3.1 *Social issues*

The World Bank and World Health Organization (WHO) estimate that 15 per cent of the global population has a disability and that millions more have a temporary or situational disability at any given time (World Bank and WHO, 2011). This article

predominantly focuses on people who are blind or have a moderate to severe visual impairment. The United Nations Convention on the Rights of Persons with Disabilities recognizes that ‘disability results from the interaction between persons with impairments and attitudinal and environmental barriers that hinders their full and effective participation in society on an equal basis with others’ (UN, 2006, 1). Despite this long-held recognition, many barriers remain to full participation in society.

Traditional print publications can be challenging, or impossible, for people with print disabilities to read. The shift from print towards digital publishing offers the potential for equal access but, despite this potential, few digital publications are fully accessible and the lack of alt text is one of the most frequently cited barriers (Kasdorf, 2018). The World Blind Union (WBU, 2017) estimates that ‘In developed countries less than 7 per cent of published materials are available in accessible formats ... and in many developing countries that number plummets to less than 1 per cent’. The aim for accessible publishing advocates is ‘born accessibility’, that is, publishers should embed accessibility from conception through to the user, so that ‘full access becomes the norm rather than being “special”’ (Hilderley, 2013, 5). Although it may not be feasible to produce born-accessible publications across all outputs immediately, it is possible to take steps in the short term to address the key barriers faced by people with disabilities.

3.2 Political and legal issues

There is currently no UK legislation that requires **all** publishers to produce accessible publications. UK service providers have a duty to make ‘reasonable adjustments’ under the Equality Act (2010). In practice, this means that most publishers provide accessible formats on request. In 2013, the Marrakesh Treaty made further provision for people with disabilities, establishing a copyright exception that allows legal copying of copyright works under certain provisions (World Intellectual Property Organization [WIPO], 2013).

The most specific legislation to date is the Public Sector Bodies (Websites and Mobile Applications) (No. 2) Accessibility Regulations (2018), which oblige UK public services (including some charities, universities, and non-governmental organizations [NGOs]) to make their websites and mobile applications (apps) compliant with the WCAG 2.1 standard.^{vii} These regulations include published PDFs and, as discussed

above, the inclusion of alt text is a WCAG success criterion (W3C, 2021d). Many independent research organizations, charities, and NGOs are not categorized as public sector bodies, although many produce public-sector-funded research. Nevertheless, the legislation is a useful benchmark against which these organizations can demonstrate their commitments to accessibility.

Also of significance to book publishers is the forthcoming European Accessibility Act (EAA). This legislation changes publishers' obligation from one of making ebooks accessible on request to one of **consistently** publishing in a compliant accessible format. The EAA applies to all ebooks and dedicated software supplied to and within the EU market from 28 June 2025, whether sold commercially or made freely available (European Parliament, 2019). It is unclear whether the UK will enact the legislation following Brexit, but UK publishers will have to comply when supplying ebooks to EU countries (AbilityNet, 2021a; Brady and Siegman, 2021). Publishers are exploring changes to their workflows to become compliant, and one of the largest challenges so far is the consistent creation of alt text (Klopstock and Thompson, 2020; Inclusive Publishing, 2020; 2021).

It is unclear whether the EAA's definition of an ebook (European Parliament, 2019) applies to some of the publication types regularly produced by independent research organizations and non-profit scholarly publishers, such as edited collections, which are similar to edited books in structure, often in PDF format. Moreover, the conversation surrounding the EAA so far has largely focused on EPUB 3 (see above), but it is less clear how PDF and HTML formats fit into the narrative. Further clarification would be invaluable for publishers who produce publications other than EPUB 3 versions of trade, academic, or professional print books.

3.3 Technological issues

EPUB 3—the most-used format for producing and selling ebooks—and metadata standards such as ONIX and Schema.org have been confirmed to be compliant with the EAA, provided that the specifications are followed (Audrain et al., 2021; W3C, 2019b). One key criterion for successful validation of an accessible EPUB is inclusion of alt text that conforms to WCAG standards for all images (W3C, 2021b). However, scholarly publications are still predominantly produced in PDF format. Adobe's Acrobat Pro and InDesign software include accessibility tools,^{viii} and

Acrobat Pro's Accessibility Checker allows publishers to identify and remediate problems with their PDF documents (Adobe, 2021).

Accessibility advocates are urging all publishers to start embedding accessibility—especially alt text—in their publications now, rather than waiting until they **must** to comply with the EAA (Martínez Calvo, 2019). Most screen reader technologies offer their users high-level reading experiences,^{ix} but can only do so when elements such as alt text are included by publishers.

3.4 Organizational and financial issues

It is frequently acknowledged that writing alt text is challenging. According to Kasdorf, alt text descriptions 'are the most common missing feature in publications—and the hardest to get right' (2018, 12). The main reasons why publishers may not include alt text in their publications include:

- time and budget requirements;
- lack of in-house skills, specialisms, and capacity;
- digital workflows largely based on print workflows are not set up to include alt text;
- judgement that the number of users whom alt text will benefit does not justify the additional cost and time;
- lack of understanding of the importance of alt text.

The narrative is moving on from the last two reasons. Nowadays, time and cost, skills and capacity, and workflows are the main barriers to consistent inclusion of alt text in publications. Although these barriers affect publishers of all sizes, small publishers and non-profit publishers such as independent research organizations often experience them to a larger degree. They are less likely to have the budget to outsource alt text to specialists and they have to consider in-house capacity carefully, especially when staff often perform multiple functions. This is particularly pertinent for organizations who disseminate their publications free of charge.

The time taken to write alt text varies from publication to publication and from image to image. As described above, some images are purely decorative, but informative

and complex images require some level of description. Writing the alt text and a long description for a **highly** complex graphic could take up to 60 minutes. This presents a challenge for publishers that regularly include complex images.

The cost of including alt text descriptions is closely related to both in-house skills and capacity and to workflow. Publishers adopt various methods of creating alt text: some outsource all text descriptions to external suppliers; others require authors to supply alt text on submission; and others use a blended approach, instructing authors how to write effective alt text that is then edited in-house or externally by subject matter experts (DAISY Consortium, 2020c). Consistency of style and language can be guided to some extent by house style guidelines, but the alt text writer must understand the content (textual and non-textual) to write a description that is contextually and technically correct.

3.5 Summary

Publishers are required to work within the legal framework of existing legislation and industry standards, and, at present, many are not legally required to make more than 'reasonable adjustments' to make their publications accessible. Nevertheless, there is clear social and moral justification for embedding accessibility elements such as alt text into publications. For publishers of PDFs, there are opportunities to do so: desktop publishing software is continually adding accessibility features that publishers and authors can use, and the accessible publishing community is producing practical guidance for publishers. The next section reviews the existing literature on the use of alt text in scholarly PDFs, and workflows for adding alt text to publications in this format.

4. Literature review

This literature review examines the key issues of PDF accessibility, with a particular focus on studies analysing the presence and inclusion of alt text in PDF publications.

4.1 PDF accessibility and the presence of alt text

Much of the literature on alt text for digital imagery has focused on web accessibility and the WCAG standards (Rajkumar et al., 2020). In comparison, PDF accessibility has received remarkably little attention, given the prevalence of PDF as a publishing

format. The (in)accessibility of PDFs and the frustrations faced by people using screen reader technologies to navigate them were first reported by Lazar et al. (2007), two of the highest sources of frustration being missing and non-descriptive alt text. More recent research with people using assistive technologies confirms that many rely on alt text, long descriptions, and captions to interpret images (Singleton and Neuber, 2020). The PDF/UA (Universal Accessibility) ISO14289-1 standard provides criteria to help PDF developers make their publications accessible (International Organization for Standardization [ISO], 2012); however, the standard and the WCAG do not extend to private companies in the UK and are often not applied.

The numbers of studies of PDF accessibility have increased in the past decade, particularly since 2018. Most of the (still very few) studies analysing PDF accessibility and alt text focus on published journal articles or conference papers. Although not all studies of alt text focus on the wider accessibility of PDFs, most PDF accessibility analyses discuss alt text as an essential, and often lacking, element. Splendiani and Ribera's studies reviewed 30 (2014) and 10 journal articles (2015), finding that none in either study contained alt text. Nganji's (2015) assessment of 200 articles published during 2009–2013 in disability-focused journals found that only three per cent included alt text. Nganji used the Adobe Acrobat Accessibility Checker and the PDF Accessibility Checker (PAC) 3 software (Access for All, 2021) to automatically assess the presence of alt text and then manually assessed its meaningfulness. The author's follow-up study of 200 articles published in the same journals during 2014–2018 (Nganji, 2018) revealed that 10 per cent contained alt text (more than a threefold increase) but that few instances provided a **meaningful** description.

Wang et al.'s (2021) recent arXiv preprint is the largest study to date of scholarly PDF accessibility. The authors analysed approximately 11 400 articles published during 2010–2019 in over 1000 journals, again using the Adobe Accessibility Checker. Alt text was the least compliant accessibility element in six of the 10 years, and alt text was found in only one per cent more of the articles published in 2019 than in 2010.

A few studies show higher levels of alt text in scholarly PDFs. Alcaraz Martínez et al.'s (2022b) recent analysis of PDFs published in 10 high Journal Impact Factor (JIF) titles recorded alt text in most of the PDFs, although only seven per cent contained long descriptions of complex images. The high level of alt text in this study may indicate that scholarly publishers are including alt text more regularly, but a closer examination of the sample reveals that 60 per cent of the journals were published by Elsevier, which has made considerable progress in accessibility (Gies et al., 2016; Gies, 2018), and therefore the results may not be representative of the sector.

In the area of conference papers, Guinness et al. (2018) found that 72 per cent of 1800 papers published in CHI (Conference on Human Factors in Computing Systems), ASSETS, and W4A (Web for All) conference proceedings during 2011–2014 featured alt text. Jung et al.'s (2021) preprint reviewed the presence of alt text in 2278 PDFs published in CHI, ASSETS, ACM (Association for Computing Machinery), and IEEE conference proceedings during 2019–2020, finding alt text in 40 per cent of the papers. Both conference studies note that CHI and ASSETS encourage authors to include alt text in their submissions, which indicates that making it a requirement in submission criteria may result in higher levels of compliance in the published versions-of-record.

4.2 Studies on the inclusion of alt text in PDFs

4.2.1 Retrospectively adding alt text to existing PDFs

There has been an increase in articles about how to identify inaccessibility in scholarly publications and how to resolve this. University library staff seeking to provide their students and staff with accessible content have examined the accessibility of the library's own digital collections and repositories (Southwell and Slater, 2012; Madden, 2020; McLaughlin and Hoops, 2021), as well as third-party databases (Rysavy and Michalak, 2020) and open access repositories (Marino and Mason, 2020). A variety of online tools are proposed for remediating and embedding accessibility (including alt text) in previously published PDFs (Devine et al., 2011; Darvishy et al., 2011; Doblies et al., 2014), for extracting the content and turning the PDF into HTML for use with screen readers (Wang et al., 2021), and for extracting chart data to create alt text descriptions (Choi et al., 2019; Sorge et al., 2015).

Although these tools are beneficial, the focus on remediation will not resolve the lack of alt text in future publications.

4.2.2 Establishing workflows to include alt text in future PDFs

Scholarly publishers are becoming increasingly interested in how they can produce accessible publications. Large publishers have written case studies on their ‘accessibility journey’—for example, Elsevier (Gies et al., 2016; Gies, 2018; Waecker et al., 2019) and SAGE (Manis and Alexander, 2018). Both the Elsevier and SAGE studies highlight the challenge of consistently producing alt text, owing to changes to established workflows, high numbers of images and the associated cost of writing alt text, and decisions about who writes it. These cases echo the experiences shared by other publishers in industry knowledge-sharing, such as webinars.

Other studies have sought to understand more practically how alt text can be included in publications. Brady et al., 2015 describe how they trialled various ways of making submitted PDF conference papers accessible; these included providing authors with guidance on PDF accessibility, outsourcing the work to an external organization after submission, and Brady and colleagues voluntarily making submitted PDFs more accessible—much of their time being spent on writing alt text. Brady et al.’s study demonstrates the time-consuming nature of writing alt text after submission. For this reason, many studies recommend that the author write the alt text because they understand the image best. Splendiani and Ribera (2014) recommend that publishers provide authors with alt text guidelines and include alt text as a requirement in submission systems; in a subsequent article, the authors present two tools for authors to use when writing alt text for journal articles—a decision tree and a checklist for writing meaningful captions (Splendiani and Ribera, 2015). Jambor et al. (2021) also recommend that publishers provide guidance for authors on how to write standardized alt text before submission. All these studies note that the requirement that authors submit meaningful alt text should be on condition that publishers provide them with clear guidance. Although the above-mentioned articles recommend that authors supply publishers with alt text, this is not reflected in the workflows of the many publishers that outsource the writing of alt text to third-party suppliers.

4.3 Summary

The literature indicates that the inclusion of alt text is relatively rare in scholarly publishing. Most studies review PDF accessibility and alt text presence from the perspective of larger publishers, choosing high JIF titles or larger conference publishers as their case studies; however, the recommended solutions and workflows are often not financially feasible for smaller publishers or non-profit research institutions.

To explore further how an independent research organization can take steps to consistently include alt text in its digital publications, a study was conducted with IDS. The study sought, first, to establish whether and how alt text was included in the Institute's PDF publications. Second, through discussions with publishing staff, it explored and analysed factors affecting the creation of alt text, to support the development of appropriate recommendations for embedding alt text in future publishing workflows.

5. Methodology and findings

5.1 Analysing the presence of alt text in PDFs

The study sought first to assess and analyse the presence of alt text in the PDF publications of IDS. The data collection was informed by the studies of Nganji (2015; 2018) and Wang et al. (2021), which used the Adobe Acrobat Accessibility Checker and PAC 3 to assess PDF accessibility. As in Nganji's studies, the data collection also aimed to discover whether the alt text descriptions were meaningful.

The period 1 May to 31 July 2021 was chosen for data collection. PDFs were identified through IDS's OpenDocs repository, which houses all publications produced from the Institute's research. Journal articles, ebooks, and grey material published by third-party companies were discounted. Initially, 83 PDFs published during this period were identified and downloaded. One publication was later withdrawn from the repository and a second proved to be outside the date range, resulting in a final sample of 81.

The Adobe Accessibility Checker tool tests PDFs for the presence of alt text descriptions (among other accessibility elements) and returns a pass or fail result

based on five alt text fields. Failure in one or more fields returns a fail result. Where alt text is present for some but not all the images, a fail result is automatically given; however, for the purposes of this study, the PDFs containing some alt text were assigned a 'partial fail' result to distinguish them from the PDFs that contained none. This decision was made only for the Accessibility Checker test and not PAC 3, because the Adobe software can be used to manually read and check the meaningfulness of alt text. PDFs that contained some alt text were subsequently studied to assess the text's meaningfulness.

The PAC 3 software provides two levels of PDF assessment, both of which are more stringent than the Adobe Accessibility Checker: the WCAG 2.1 and PDF/UA standards. PAC 3 assigns a pass or fail result for the alt text fields for both standards. During testing, both WCAG and PDF/UA returned the same result for each PDF, and therefore one joint pass or fail result was assigned. Table 1 presents the findings of the two tests.

Table 1: Findings of the Adobe Accessibility Checker and PAC 3 tests

	Adobe Accessibility Checker		PAC 3	
	Number of PDFs	% of sample	Number of PDFs	% of sample
Pass	6	7	-	-
Partial fail	12	15	-	-
Fail	63	78	80	99
Unreadable	-	-	1	1
Total	81	100	81	100

Source: Author's own.

5.1.1 Presence of alt text according to the Adobe Accessibility Checker

Six PDFs received a pass result from the Adobe Accessibility Checker. Each of these contained only decorative images, which were correctly assigned as decorative. Interestingly, five of the six were on the topic of disability, which may explain their greater attention to accessibility standards. Twelve PDFs received a partial fail result, containing alt text for some but not all their images. Of the 63 PDFs that failed the test, 34 (54 per cent) contained only decorative images, meaning that a pass result could have been achieved by simply marking the decorative images as such. The other 29 PDFs that failed (46 per cent) included informative or complex images (in addition to decorative ones) that required alt text.

5.1.2 Presence of alt text according to PAC 3

PAC 3 tested the PDFs against the WCAG 2.1 and PDF/UA standards, which, as noted above, include more criteria than the Adobe Accessibility Checker. This was reflected in the test results: of the 81 PDFs, one file was unreadable by the software and the other 80 PDFs (99 per cent) failed. Further analysis of the six PDFs that had passed the first test revealed that they failed the second owing to a lack of alt text for content other than images, such as hyperlinks. This demonstrates how the PDF/UA and WCAG standards require a higher level of compliance and that organizations must consider which level of compliance is feasible within their resources.

5.1.3 Presence of meaningful alt text

Once the presence of alt text had been established, the meaningfulness of the text descriptions was analysed. The Adobe Accessibility Checker allows the user to view alt text descriptions, see whether they were computer generated or human generated, and manually assess their meaningfulness. As the six PDFs that passed the first test contained only decorative images, the analysis focused on the 12 PDFs that received a partial fail result. Each description was manually assessed against the definition of meaningful alt text given above: the alt text should provide information comparable to the image. The alt text was assigned a yes result for meaningful text and a no for meaningless text.

All 12 of the PDFs contained computer-generated alt text, none of which provided information comparable to the image. Most contained either numbers or the word 'diagram', but others were entirely incorrect. For example, a timeline contained alt text that read, 'A picture containing light, night sky.' The software, unable to understand the image beyond the basic visual elements, presumably interpreted the circular points on the timeline as stars. A second example was a bar chart that contained two columns of different sizes, for which the computer-generated alt text read, 'A screenshot of a cell phone.'

The tests revealed that alt text was not purposefully included in the editorial and production workflows for the sampled PDF publications, mirroring the findings of similar studies. Computer-generated alt text was found to be non-descriptive and incorrect, confirming that this function in publishing software cannot be relied upon.

5.2 Focus group discussion exploring factors affecting the inclusion of alt text

The study next sought to explore and analyse the factors affecting the inclusion of alt text in IDS publications, to ensure that any recommendations were contextually relevant. IDS publications are produced by publications, communications, and project support staff working in the centralized Publications Team and in the Institute's research projects and programmes. The qualitative research element therefore focused on generating in-depth understanding of the topic from the perspectives of these staff. A focus group discussion (FGD) was chosen to collect shared experiences and facilitate dialogue on the topic.

Recruitment of the five participants was purposive to ensure the group represented publishing-focused staff from across the Institute. The group was intentionally small enough to allow sufficient time for detailed responses but large enough to generate discussion (Hennink, 2014). Consideration was also given to the balance of the group and potential power dynamics that could hinder people's participation in the discussion (Krueger and Casey, 2009). Informed consent was obtained from each participant during recruitment.

Conducting research within one's own institution can raise ethical issues such as anonymity and create potential for bias (Krueger and Casey, 2009).^x Potential for

bias was addressed by preparation and use of a discussion guide (Hennink, 2014). The discussion script was anonymized during transcription and, as far as possible, any identifiable information was removed. Participants were given the option to review and sign off the transcript.

Owing to the COVID-19 pandemic and work-at-home guidance, the discussion was held via Microsoft Teams. Much participatory research has been conducted online during the pandemic out of necessity and this has presented several benefits for researchers and participants in terms of access, costs, and environmental considerations (Howard and Roberts, 2020; Howlett, 2021), but it can also pose challenges, such as connectivity issues, lack of non-verbal communication, and privacy issues (Hall et al., 2021; Lo lacono et al., 2016). To generate as much non-verbal communication as possible, participants were asked to keep their cameras on. To allow all participants to speak in turn, they were encouraged to use the hands-up function in Teams.

The discussion on the factors affecting the inclusion of alt text revolved around four interconnected themes: (1) guidance and capacity-building; (2) time; (3) budget; and (4) who writes and edits alt text?

5.2.1 Guidance and capacity-building

The participants all expressed a desire to understand alt text and use it better. Each explained that their involvement with alt text to date had been on websites and/or social media, but not in publications. This corroborates both the results of the PDF analyses and the literature review finding that use of alt text is more prevalent on websites and online platforms.

The types of complex images regularly published in IDS outputs—such as graphs, charts, and infographics—were highlighted as a specific challenge, and it was felt that internal guidance specific to these types of images would be highly beneficial. The discussion included several requests for guidance and skills-building, such as on the types of images that require alt text and why, the desired length of text descriptions, and what is expected of alt text writers.

Alongside a desire to understand more about how alt text is written was an awareness of the apparent contradiction of writing a text description for content whose purpose is intended to be visual, including how the image could best be described textually and what might be lost in the process. This was further expanded on when the group discussed who writes alt text and quality control.

5.2.2 Time

The time factors affecting inclusion of alt text related to two main areas: the time taken to write it, which was connected to the complexity of the image; and the amount of time in which staff have to write it. These factors were linked to budget considerations, which are discussed further below.

One participant shared their experience of writing alt text for a programme's social media account, stating that 'The additional time that it took to write alt text for images and graphics was a barrier to it' (FGD3). There was agreement that the complexity of the image would determine how long it would take to write the text. Simple images such as photographs were generally considered easier to describe than data-driven images such as charts and infographics, provided that the photograph does not require a technically specific description.

In addition to the writing time, it was acknowledged that if somebody other than the author writes the description, the author also needs time to check that the description accurately reflects what they meant to convey. One participant raised this in relation to infographics, highlighting that this quality check would be as much about the **language used** as the technical accuracy of the description: 'I personally [as a communications professional] would use different language to the author to convey the meaning behind an infographic' (FGD5). Similarly, one participant described a situation where they had tried to replace a graph with a text description. The authors of the piece had 'immediately said, "No, no, it doesn't convey the image properly"' (FGD2). After this experience, the participant was keenly aware of the complexities and time involved in writing alt text descriptions.

The second factor was the amount of time available in the production process to write alt text. Participants shared their experiences of how the sourcing of images often happens late in production, which allows little time to write and sign off alt text.

Suggestions to avoid this included requiring the author to submit the alt text with the image or asking the communications or publications staff assigned to the title to work with the author earlier on to identify images and establish descriptions. In the latter case, the participants explained, the editorial staff embedded in a research programme will have a high degree of involvement in the development of a publication before production and therefore may be best placed to provide this support.

5.2.3 Budget

Time and budget for research programmes are interlinked because staff time is written into the budgets of grant-funded research proposals, often in the form of days. A big point of conversation, therefore, was about how the time taken to write and edit alt text could be estimated and accounted for at the grant proposal stage of a research programme, ahead of the grant even being awarded and often a year or two before any publications are produced. This is a consideration not only for research organizations but also for publishers of all sizes seeking to quantify and cost the creation of alt text for their future publications.

There was no unified recommendation on how to budget for the costs associated with alt text. One suggestion was to estimate an average number of images per publication, recognizing that the number of images per publication will fluctuate. For multi-year projects and programmes, the costs could be budgeted per publication and multiplied by the number due to be produced during the project's life cycle. An alternative suggestion was to treat alt text as a separate, publications-related item in the overall project/programme budget, in the same way that large costs for open access and translation are listed as separate lines in the grant proposal budget.

5.2.4 Who writes and edits alt text?

Much of the discussion about who writes alt text overlapped with the time factors discussed above. The question received various responses based on the participants' experiences of writing alt text and of working on publications in a variety of projects and programmes.

One view was that ‘the best person to **start** writing the alt text is whoever is creating [the image]’ (FGD3, original emphasis), owing to their closeness to the image and understanding of what it intends to convey. This was suggested with the caveat that the person with overall responsibility for producing the publication will ‘need to translate that a little bit and make [the language used] a bit more accessible’ (FGD3).

A different view was that the communications or publications staff assigned to a publication, who have subject-matter knowledge and/or editorial skills, would be best placed to write the alt text with input from the author.

There was much discussion about whether the author should write the alt text. As noted above, this is the route taken by several scholarly publishers. Most participants felt that there would be a degree of ‘pushback’ from authors if they were asked to write alt text for every image on top of the other activities involved in getting a manuscript to publication. This was not a universal opinion, and a notable exception was in the case of complex graphics, particularly those the author had developed. Here, the participants felt that the author might prefer to provide draft alt text and sign off any subsequent edits. It is interesting to note that these opinions differ from the recommendations of many studies of PDF accessibility, which strongly recommend that, for the most effective workflow, authors should write alt text.

Several participants noted quality control and providing a technically accurate and effective description for use with assistive technologies. They suggested there should be a point of contact in-house to whom staff could go for both advice on and approval of alt text before publication, and who would also provide staff training and capacity-building. Similarities were drawn between the creation of a specialist accessibility role and the in-house data protection role—a ‘champion or an expert’ who can provide advice and checks before publication.

5.3 Limitations

The study has a number of limitations. The participants were a sample from across the IDS staff who work with publications; their experiences and perceptions of factors affecting the inclusion of alt text are fairly generalizable across such roles. However, each research project or programme is unique and a larger sample across multiple FGDs might have revealed other perspectives before reaching saturation.

Owing to time restraints and to avoid mixing groups of participants from different levels of the organization, separate FGDs were not facilitated to gain the perspectives of authors within the Institute. Before a workflow is proposed for including alt text in the Institute's publications, it will be essential to understand authors' views on the factors affecting the inclusion of alt text, especially in relation to who writes it.

6. Conclusion and recommendations

Alt text is an essential element of accessibility for people who are blind or have a moderate to severe visual impairment. In light of this, advocates of accessible publishing are encouraging publishers to prioritize the inclusion of alt text in their workflows. Many publishers have a strategic focus on reducing inequalities, both in their publications and within the organization. Producing accessible publications is one way they can reflect such values, and considerable progress is expected between now and June 2025, when the EAA comes into being. This section reflects on the findings of the IDS case study and literature review, considering the implications and providing recommendations not just for the organization studied but for similar research organizations and smaller publishers that wish to include alt text in their PDF publications.

6.1 Strategy

Accessible publishing requires a whole-organization approach, and it is therefore essential to receive buy-in from senior leadership when one is seeking to establish accessible workflows. Before PDF publishers and senior leadership consider how to consistently include alt text in publications, a key initial step is to establish which standard the organization can feasibly hold itself to with available resources, whether the Adobe Accessibility Checker, WCAG 2.1, or PDF/UA. A baseline standard may be identified for the short term, with a view to increasing the criteria over a set period. The choice of standard may be entirely up to the organization, depending on available resources, or may be determined by legislation such as the Public Sector Bodies Accessibility Regulations.

The production of alt text often requires organizationally appropriate changes to workflow, skills, capacity, and costings, in ways that do not overburden authors,

editorial staff, or budgets. Organizations must explore how alt text can be sustainably and consistently budgeted for individual outputs, whole projects, or across lists. For research organizations, this will involve consideration of how alt text can be costed in grant proposals years in advance of publication. For example, an additional percentage of funding per publication could be requested from funders in order to make the outputs accessible. Approaches must be organizationally specific, reflecting on existing skill sets and capacities and the costs and trade-offs associated with outsourcing alt text to external vendors, writing in-house, and/or requiring authors to provide initial text that is subsequently edited.

Checking and remediating Adobe PDF accessibility requires access to the Adobe Acrobat Pro subscription-based software. It is recommended that senior leadership make subscriptions to the Pro software available to all staff who produce PDFs, to enable them to embed accessibility as standard.

Consider creating an internal accessibility lead, or accessibility advocate role, within the organization. An internal lead will be a point of contact and source of practical guidance and training for staff who are writing and producing publications, an advocate for accessibility and awareness-raising, and an advisor on compliance with future legislation and accessibility requirements.

6.2 Training and guidance

The FGD found a willingness to publish alt text and a desire to understand how to write it. There are many freely available and excellent resources for writing alt text for publications. Of particular importance is guidance on the creation of **meaningful** alt text for the types of images produced most often by the organization. For scholarly publishers, the Benetech DIAGRAM Center's resources and the DAISY Consortium webinars explain how to write structured, meaningful alt text for complex images such as graphs and workflow diagrams. The FGD participants felt that institutionally specific guidance and capacity-building could be beneficial for organization-wide adoption of alt text—and that this would also benefit the descriptions written for websites, social media, and other digital resources.

The analyses of the sampled PDFs revealed that none included intentionally written alt text, mirroring many previous studies. Although wider training and guidance on all

areas of alt text are being prepared, the findings identified two clear quick wins for publishers to adopt in the short term:

1. **Computer-generated alt text.** The alt text found in the 12 sampled PDFs was both meaningless and incorrect, such as the 'mobile phone'. Demonstration of how staff can prevent automatic, computer-generated alt text in Microsoft Word and desktop processing software will prevent incorrect image descriptions being embedded without their knowledge.
2. **Decorative images.** The analyses found that over half of the PDFs that failed the Accessibility Checker test only did so because a tick box had not been checked to class the decorative images as such. Guidance for staff on identifying these types of images and how to assign them as decorative will improve accessibility and also feed into understanding of the volume of informative and complex images that are included in their publications.

6.3 **Workflow**

Designing a pilot trial and workflow for including meaningful alt text can generate practical experience and feedback before the procedure is revised and extended to the wider organization. This could involve specific journals, series or lists, or the publications of a particular research programme or project.

The FGD revealed several differing opinions about who should write and edit alt text and about the level of involvement of authors, communications, and publications staff. It is important to seek the perspectives of editorial staff and authors and generate buy-in when developing new procedures, rooting them in the day-to-day realities of the people who will be most impacted upon by the change, while also being mindful of organizational capacities and budgets. A pilot can help establish who is best placed to write and edit alt text in the context of the organization and generate learning before the workflow is extended to a wider group. A single approach may be most appropriate for some publishers, but not all. In research organizations that have multiple, large programmes working on distinct sets of publications with differing budget levels, often across global consortia and partnerships, the responsibility for writing and editing alt text may vary across projects or even across series.

In summary, alt text is undoubtedly a particular challenge for scholarly publishers, and perhaps especially so for non-profit and small publishers. But, as reflected throughout this article, accessible publishing is a journey and unlikely to be instantly implementable. This article has sought to highlight some of the key factors that may affect the inclusion of alt text in PDF publications. It is hoped that the recommendations will encourage and help publishers to take incremental steps towards alt text workflows that are sustainable in the long term.

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ⁱ The DAISY Consortium.

ⁱⁱ Accessible Books Consortium.

ⁱⁱⁱ Inclusive Publishing.

^{iv} IDS.

^v IDS OpenDocs.

^{vi} Based on data from Global Burden of Disease Blindness and Vision Impairment Collaborators (2021) and World Bank (2020).

^{vii} The Public Sector Bodies (Websites and Mobile Applications) (No.2) Accessibility Regulations (2018).

^{viii} It should be noted that the PDF Accessibility function is not available in the free Adobe Reader software.

^{ix} epubtest.org

^x The author has been a member of the IDS Publications Team since 2014.