

University of Southampton

Frode Alexander Hegland

Dame Wendy Hall, Les Carr & David Millard

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Visual-Meta ACM

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1 ABSTRACT

This document is based on my ACM article on Visual-Meta and has been exported from Author to PDF to illustrate a native export. It is designed to be read in Reader.

Visual-meta is an approach to make a document's metadata equally readable by human and machine (not hidden from view), by adding an appendix to the end of the document. Based on the de facto interchange standard BibTeX, the visual-meta Appendix presents all the information needed to cite the document (author, title, date, etc.) as well as clearly stating the values of any data (such as tables, lists, advanced layouts, etc.) and glossary terms. A visual-meta aware PDF software reader will then 'read' the document and find the visual-meta appendix which it will load this into memory. This will enable advanced functionality such as copying text and pasting it as a citation in one step, without interfering with legacy PDF readers. It will also reduce the need for citation managers and increase the opportunity for development of advanced citation management systems [1] [2] [3]. The work is inspired by and supports Doug Engelbart's push for an Open Hyperdocument System with xFile including the embedding of metadata for the use of advanced ViewSpec on reading. For further information, including links to proof-of-concept software and a demo video: liquid.info/visual-meta.html

2 INTRODUCTION

PDF documents have become the de facto standard for exchanging documents within academia including in the ACM Digital Library. The PDF format supports metadata but this is rarely used, even for such basic information as the name of the authors, the title of the document or the publication date. The visual-meta approach aims to solve this, by including the metadata for citing and for document analysis in a robust and accessible way.

2.1 Limitations of Embedded Metadata

Embedded Metadata Fragility, that is to say, metadata which is not visually accessible to the user but hidden inside the document container, is easily lost if the document changes format or if it is printed out and scanned then processed. Furthermore, metadata is rarely added to PDF documents on production, even though the procedure is not technically arduous. For example, this can be seen by downloading any arbitrary PDF from the ACM Digital Library.

2.2 Limitations of Citation Management Software

Citation Management (CM)–or Reference Management–software tools [4], such as Mendeley, Zotero and EndNote, vary in their feature set [5] but primarily collect citation data into one or more databases from which citations can be exported in a desired publishing format. CM software has several limitations:

- **Flat Documents.** Some CM tools allow integrated insertion of formatted citations and bibliographies directly into the user’s writing environment, for example Mendeley’s plugin for Microsoft Word. This is through the CM database and not directly via the source document so a direct quote becomes a cumbersome operation through different systems.
- **Lack of Portability.** The user can move their citations lists by exporting to a RIS document (Research Information Systems) to other citation management software but again, this only exports a list of citations, not the documents themselves and introduces further chances for errors.
- **Constrained End User Capabilities.** For the end user the limitations include cumbersome citation adding when not ‘living’ in the CM tools, such as a lack of ability to

simply copy from a PDF and paste as a citation without a trip via a CM.

- **Constrained Innovation.** For researchers and software developers seeking to experiment with novel approaches to citation management, the need for the user to manually enter citation information for large sets of documents becomes cumbersome and will keep users locked into current CM systems.
- **Uncertain Provenance.** Furthermore, not having the metadata included on publication increases the risk of errors, as is common with citation database derived data.

3 BENEFITS OF VISUAL-META

The visual-meta approach is to visually ‘print’ the metadata into the document as ordinary document text, displaying it in the same way as all the other text in the document means that the contents contains its own metadata—it’s not just connected through some technical means. This means that the documents are are not reliant on CM databases—they are fully self-contained with the content and metadata in the same document and on the same substrate. The result is that the document effectively becomes ‘self aware’ [6] and able to communicate what it contains to other software, providing a host of benefits, as outlined below.

For an author this approach means they can embed more rich information in their document with minimum effort and be sure of the robustness of the information over time.

3.1 Immediate Benefits

- **Quick Citations.** Users can copy from a visual-meta PDF and paste into a visual-meta aware word processor in one step. This gives the reader a faster and more robust way to cite with a higher degree of accuracy and more access to the original data and interactions.
- **Increased Provenance Robustness.** Since all the metadata is ‘baked’ or ‘printed’ onto the same substrate as the content of the document, there is less likelihood of the metadata being incorrect. (The manual addition of visual-meta post-publishing—described below in section 7 ‘Adoption Support’, includes a tag of the source of the added meta to allow for verification of even the user-added visual-meta. If and when the visual-meta becomes standard, this step will no longer be required). This also provides a strong benefit for publishers, whose works will be more accessible and connected.

3.2 Further Benefits

- **Augmented Textual Interactions Across ‘Frozen’ PDF.** Using the appendices to describe the document content, such as the formatting of headings and citations as well as the use of glossaries, can allow the reading software to present the document to the reader’s preference and interaction styles, all-the-while not interfering with the frozen nature of PDFs.
- **Server Friendly** by making it explicit how the document is formatted, how citations are used and what glossary terms it contains. This means that servers can interrogate the

documents in bulk, which will allow for large scale analysis. The University of Southampton's Christopher Gutteridge, one of the people behind the university repository, elaborates on this: jrnl.global/2019/07/01/ideas-for-rich-documents

- **Formatting Flexibility.** Institutions can worry less about the cosmetics of citations and benefit from more documents cited being checked and read. This could put an end to the academic time-wasting of nit-picking the way citations should be displayed: Visual-meta lets the teacher/examiner/reader specify how the citations should be displayed, based on the document having described in an appendix how they are used and therefore the reader can re-format the the readers tastes. Keep in mind that different journals and academic institutions have their own specific formatting requirements within the major categories which numbers in their thousands. The over-complicated nature of references in academia can be seen in the official guide from ACM for the submission of this article, where the year is in brackets for journals but not for book, titles are italic if the book has an editor and there are full stops between initials in articles if the text was from a journal article but not if it was found online and so on.
- **Analog-Digital.** This approach closes the gap between analog and digital documents, allowing each media to increase the value of the other [7], through keeping all metadata attached through printing and scanning.
- **Robust Archives.** The robustness of this approach can become a great benefit for archiving the documents by being able to keep metadata through document conversions and even though a user printing and scanning the document and then applying OCR.
- **Better use of Sources over Time.** Encouraged by making it significantly faster and easier for authors to find and cite sources in formats approved by readers and higher likelihoods of readers following citations they are not familiar with since the system can support rich interactions such as inline citation identification.

4 SUPPORTED END-USER INTERACTIONS

- **Copy As Citation** using a simple copy command, with all citation information being added to the clipboard payload for use by Visual-Meta aware applications on Paste
- **Instant Outline & Advanced Layouts** based on the visual-meta specifying heading formatting and spatial layouts, allowing for spatial hypertext [8] and integrated concept map and/or mind map [9] support etc.
- **Retained Data.** Source datasets, including tables and other data, can be explicitly made available, along the lines of digital native/‘living documents’ [10].
- **Glossary Support.** The benefit glossaries can confer onto the reading experience have not been richly developed and this could be because there is no readily available mechanism to carry the glossary list along with the text. Visual-meta provides the ability to add glossary terms and their definitions and links to the document, for use by the reading software.
- **High Resolution, Document Based Addressing.** The Name of the document is not the same as the title. This can be used to address by document rather than by (fragile) link location. This can additionally support High-Resolution Addressing, as described at wordpress.liquid.info/addressability-supplemental-augmentation-for-visual-meta/

5 PROOF OF CONCEPT

The initial focus is on PDF documents but the concept is applicable to any document format that has a visible component.

Visual-Meta Export is built in to the ‘Liquid | Author’ word processor, while the ‘Liquid | Reader’ PDF reader application is the first Visual-Meta aware PDF reader. This comes from the perspective that to better understand the system it is useful to experience it and iterate [11].

Both are produced by the author of this article, Frode Hegland and are available in the macOS App Store^a or from www.liquid.info

6 FORMAT

BibTeX is used as the base format since it is widely adopted, is easily human-readable, compared to formats like RIS, and can be automatically copied from a repository/download location and appended to the document, as described above. Alternatives, such as RIS are not as human readable friendly.

Visual-meta supports the full BibTeX information associated with the document for citing, but also contains information to make the formatting and contents of the document explicit, in the following order:

Version (of visual-meta)

Generator (of visual-meta and document)

Source (of visual-meta if added to existing document outside of editor, such as described in section 7, ‘Adoption Support’)

BibTeX (full BibTeX citation metadata)

Formatting (descriptions of headings, captions etc. for the reader software to be able to provide active outlines and more, not for necessarily using the same fonts etc. in a new rendering)

Citation (list of citations used)

Glossary (terms with definitions and links)

Special (any special data, introduced with a human-readable description)

7 EXAMPLE

7.1 Introduction

Visual-Meta

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@{visual-meta-start}
@visual-meta{
version = {1.0},
generator = {Author 5.3 (812)},
}
```

7.2 Citing

```
@article{
author = {Frode Alexander Hegland},
title = {History of Citations},
year = {2020},
institution = {Liquid Information},
}
```

7.3 Structure

```
@headings{
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  {"name":"History", "level":"level1"},
  {"name":"Religious Developments", "level":"level2", "author":"Niels Ole Finnemann"},
</json>
}
@{visual-meta-end}
```

8 ADOPTION SUPPORT

Compatibility with legacy PDF readers is maintained since they will see the metadata as plain text and not as any potentially malicious added information.

When using a supported PDF reader, the user can download a PDF and copy the BibTeX export format from the download page, then open the PDF in Reader and click to ‘Assign BibTeX’ and it will be applied as an appendix and saved, same as if it was natively exported with Visual-Meta.

Only the citation information will be provided in this way, formatting, etc. will not be available. Reader applications can also send non-visual-meta PDFs to a server, such as Scholarcy to have the Visible-Meta extracted and appended. Within the proof-of-concept applications, this can be done through Liquid.

The visual-meta approach has been formally proposed to the PDF Association: <https://www.pdfa.org/a-visual-meta-approach>

9 CONCLUSION

Reducing friction in communication and providing stronger links to source are two ways to improve academic communication in the short and longer term and putting the meta-data on the same level as the contents provides strong archival support. We may be able to follow Vannevar Bush's associate trails [12] yet, if we make the paths along the trail truly fluid to create and follow the information within them open to interactions.

10 ACKNOWLEDGEMENTS

The concept grew out of work on Liquid | Author, as described at: wordpress.liquid.info/visible-meta-origins and my work with Doug Engelbart on high resolution addressability. This is part of my PhD work at the University of Southampton under Dame Wendy Hall and Les Carr. It aims to solve infrastructure issues which hamper citation interaction and the development of visualisations: wordpress.liquid.info/how-visible-meta-relates-to-my-phd

The work has been supported by the mentoring of Doug Engelbart, the dialog with Ted Nelson and Vint Cerf and the input of my academic advisors Wendy Hall and Les Carr. The proof of concept software was implemented by Jacob Hazelgrove.

Glossary

"BibTeX" BibTeX is reference management software for formatting lists of references.

This is a/an technology.

wikipedia: <https://en.wikipedia.org/wiki/BibTeX>

"Glossary" in this context is means a local definition which the author or editor has added.

This is a/an concept.

"PDF" Portable Digital Format, the primary academic digital interchange format.

This is a/an format, technology.

Endnotes

^aThis is an example Endnote to highlight that the software is for macOS, not iOS.

References

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DOI: 10.1145/227181.227186.

Visual-Meta

@description 1

What this is, as described for anyone who would like to support it in their software systems: Visual-Meta is based on the academic BibTeX citation information in LaTeX with added (optional) JSON to describe the document you are reading, in order to enable rich interactions which are otherwise stripped from the document when exported to PDF or other delivery documents. The way reader software looks for Visual-Meta in a PDF is to parse it from the end of the document and look for the @ (visual-meta-end) tag. If this is found, the software then looks for the @ (visual-meta-start) tag and uses the data found between these marker tags. The introductory section, @ (visual-meta), specifies which version of Visual-Meta is used, followed by what software generated the Visual-Meta. This can be the software which created the document, generator or software which appended the Visual-Meta onto the back of a previously created document, for example, with our "Reader" application which looks for a DOI on the first page of the document if no Visual-Meta is found, and asks the user for permission to resolve the DOI into a BibTeX entry which can be inserted into the document, as described next. The first informational section is usually prefaced by @ (article for articles/papers or @book for books). The difference is useful to determine how to display the document, for example, in our "Reader" software @book opens to a single front page in full screen. This section further includes standard BibTeX information which should be appended to the clipboard/copy space when copying any text from the document, in order to allow the software—for example a word processor—the user pastes into to paste as a full citation, which the software can then automatically list in a Reference section on export. The above is required and the following is optional: The @ (headings) section is in the <json> format and it specifies what text is a heading, what level heading it is as well as the name of the author for that section, if the section was authored by someone else than other sections which should also be added when copying text from that section, to allow the pasted citation to correctly cite the author. When specifying the name of an author that name will remain valid until another author is specified. @ (glossary) This section lists what terms are in the glossary. Feel free to add your own tags but please describe them in this introduction section in order for others to derive value from them now and in the future. This was written February 2021. More information is available from <https://visual-meta.info> or from emailing foode@visual-meta.info.

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@ (visual-meta)

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title = (Visual-Meta ACM),
month = mar,
year = (2021),
institution = (University of Southampton),
}

@ (headings)

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"name": "3.2 Further Benefits", "level": "level2",
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"name": "6 FORMAT", "level": "level1",
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"name": "9 CONCLUSION", "level": "level1",
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"name": "Visual-Meta", "level": "level1"]]
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