

# **Initial VR thoughts for FTL**

# Contents

<b>Visual-Meta document into AR/VR, interacted with and then taken out</b>	<b>4</b>
The Concern	4
TL : DR	4
Premise : Augmented Environments focus	5
Potential Projects	6
<b>And then I ramble, feel free to ignore or skim or whatever you prefer</b>	<b>8</b>
I start with a scenario and then stop	8
Area of interest : Objects & Spaces	8
Book Binding	9
Book Connections	9
Hiding data as important is spawning data	9
<b>A run of questions (probably not worth reading but included for future ref)</b>	<b>11</b>
Visually	11
What space	11
Interactions	12
Hand language	13
The dimension data problem	13
Time box?	14
Value of the computer rectangle display and documents	14
Game environments	14
'Folders' in thin air...	15
Visuals	15
<b>Conclusion(s)</b>	<b>16</b>
Another stab at a scenario	16
Experiment Lab	17
How to Edit this?	17
<b>In sum</b>	<b>18</b>
What should I do?	18
What area to work on? What is AR uniquely suited to solve?	18

<b>Appendix : Who am I?</b>	<b>19</b>
<b>Appendix : Lists</b>	<b>20</b>
In VR with a full PDF with Visual-Meta, all the elements VM includes will be available:	20
A break in thinking to list a few professions we might want to augment:	20
Stuff we have available includes:	20
Stuff people need to do to work:	21
I will therefore also look at what kinds of data we have available to play with, to help with my thinking:	21
<b>Glossary</b>	<b>23</b>
<b>Endnotes</b>	<b>35</b>
<b>References</b>	<b>36</b>
<b>Visual-Meta Appendix</b>	<b>37</b>

# Visual-Meta document into AR/VR, interacted with and then taken out

This is simply my *flow of thought* on ‘augmented environments’ (AR/VR/Projection etc.) and where we might focus.

## The Concern

I am concerned that once high quality (great visuals, accurate hand, face etc. tracking, lightweight and affordable) headsets for AR/VR happen, most likely by Apple, there will be a further burst of games and social spaces. However, work in this augmented will be shown in quite rudimentary ways, since the purpose of the large companies making and selling the hardware and operating systems is to sell to as many people and thus make the onboarding as easy as possible. I think there is a huge opportunity cost here. The new affordances made possible through, effectively employing our occipital lobe to support our prefrontal cortex, much like graphics cards supported CPUs, is immense. I firmly believe that if we don't show the world demonstrations of what it can truly be to work in this environment, the loss of collective imagination opportunities will be immense. I have gone through the question of asking who I am to work on this and concluded it doesn't matter, it doesn't much matter who I am, it's more relevant what I think this is important.

## TL : DR

To me, the aim of our work is **to communicate the power of working in augmented environments, through building systems and promoting the concept in dialogue with the wider community.**

We should ideally build a real, experimental lab where we can change the variables for how things appear, how we can interact with them, what data we can access and how to hide the data when not needed.

We should further invite great thinkers in augmented environments to host guest speaker slots and publish on augmented environments and work. Brandel and I are both inviting people into the recorded dialogue. I hope we can go further and deeper.

## Premise : Augmented Environments focus

I have decided that I think it might make most sense to discuss this as ‘augmented environments’ (AE?), rather than VR or AR/VR/XR and in other cumbersome ways. I

It also ties well with my (new as of last year) company name of the Augmented Text Company. I didn’t like the term ‘augmented reality’ since I felt it rather clumsily interfered with Doug Engelbart’s notion of augmenting human intellect (Engelbart, 1962) but then I read Jaron Lanier’s book (Lanier, 2018) on his VR history and it turns out that the person who pressed for the term ‘augmented’ reality was an engineer at Boeing and since Doug’s lab was transferred from SRI to Tymshare in the late 1970s, which was acquired by McDonnell Douglas in 1984 so this suggests that the engineer was likely aware of Doug’s work since they were in the same community, but of course that is only an interpretation. Based on a quick Google search I find that Thomas P Caudell of Boeing coined the phrase “augmented reality” in 1990<sup>a</sup>. Further I learn that he worked at Boeing’s Computer Services Research<sup>b</sup> which adds to my theory. The name David Mizell also comes up, but no direct connection to Doug via him either.

Anyway, it will be interesting to design whole environments but for a knowledge work perspective it’s probably more important to focus on the knowledge objects in the space, and that can happen in AR or VR, and AR looks to be most pursued by developers such as Apple<sup>c</sup>.

Anyway, anyway, we are looking to augment how we work, inspired by Doug, so I’m happy with referring to, and focusing on, AR, even if the experience is VR (as it is in the Oculus Rift 2 many of us use) since we don’t interact much with the background.

## Potential Projects

Since this is long and rambling, and even though I passionately believe we need to really analyse the potential user and use, we can also take inspiration from the potential future phone call from a friend who is a general knowledge worker (aren't we all these days?) in business, academia or something else, who says: "The Apple AR glasses just dropped! They look cool and the spec's are great for AR specs (see what I did there?) but they are quite expensive. Should I buy a pair?" To which our reply should be: "Yes! Absolutely, because they will allow you to do something you cannot do very well on traditional rectangle displays" and then we need to choose a project to work on to be included on that list. I have thought and listened and this is the list as I see it so far. Additional inputs welcome of course:

**Library.** Allow you to find books and documents you have in your library with much more ease and better context. This can be a shelf by default or a timeline citation map if you like. Lines can show citations and keyword similarity mapping. The library can also be based on people or categories, as well as alphabetical or by publication, all at the same time or all at the flick of your wrist so to speak.

**Library Books.** I named it thus since we should also think about documents, using Visual-Meta, and how they can be presented to an augmented library: What aspects should be made available of the document for the library to use for to display it and how to relates to the rest of the documents?

**Finder.** Allow you to find and organise all your documents and work. Maybe the biggest opportunity but also the most likely to be done by the headset provider. There has been much work done in this space but we can go much further.

**WikiData viewer.** Allow you to build visual castles in the sky to see how data relates. Time axis, implicit and explicit links and more.

**Graph View** of your knowledge to see connections and share. How to share? Who will 'own' the data structure? How can we link to what is not right in front of us, how can we hide aspects of this?

**Memory Palaces** where you place knowledge in your environment(s) so you can think and

walk. This would likely include most the other potential projects here and would also introduce the notion of being in dialog with someone virtually and being able to share things: Shapes, data and so on, while you are walking, moving. How can you tell the system what should stay put and what should follow you? What would the other person see?

**Timeline & Calendar** where you can plan for the future and see the past as a diary with manually added diary posts as well as automatically added layers of weather, locations you were on, access to transcripts and historical and financial events etc. Imagine a column stretching like a loom and you can choose to expand and contract it with hand gestures. You can choose a timeline substrate or geographic substrate. Questions of interaction and views will be paramount. Data should be relatively easy to access in general.

At the bottom of this would be the data and code, of which I think Visual-Meta could be a small part. What would also need to underlie this, to underpin this, would be the user's visual interaction of portability. How can these different things be spawned, hidden and 'carried around'?

And then I ramble, feel free to ignore or skim or whatever you prefer

I start with a scenario and then stop

User enters a VR space, ideally a nice room which looks like it could be a Horizon's Workroom or something like that. A virtual desktop is present and the user opens a PDF which has Visual-Meta on it and imports it into the full virtual space.

How this is done will need to be discussed.

The user then opens up what looks like a beautiful 3D knowledge graph of their work and how it connects to the group. Anyone in the room can give a link to their own graphs/sculptures/constellations and the shape can grow and contract.

And this is to me where I need to pause, there are too many other issues to consider.

Area of interest : Objects & Spaces

Personally, I think we should focus on knowledge objects, not geography, games or social, since those will be heavily focused on my others with tons more resources. Multi-use and interaction of knowledge objects, yes absolutely, but not a focus on avatar-avatar interaction.

Having spent some quality time in VR over the last month (by no means as much as some in the group, particularly Brandel of course) it has become clear to me that room scale VR will be quite ambitious since not many people will have a full free room to walk around in to do VR work.

AR constrains us to physical rooms which will not be uniform between users, which may impact group work.

My experience has made me feel that that sitting for traditional 2D work and then standing up for AR work, though still by the users desk will be default mode for work AR. We should therefore consider that we are designing a virtual cockpit, more than a room, and more than a walk around environment, though of course there needs to be freedom to move.

I picture a shared space in front of the user where virtual objects can be shared but what the user has chosen to 'pin' to their walls or other spaces will be private unless the user chooses to share them since likely the space above a desk (just as a rough size, not



necessarily having a desk) will most likely be the only space size shared in a group.

It seems Apple is also thinking of their AR device as being for specific use, not long use<sup>d</sup>.

And then Brandel ruins this by saying he wants to walk. OK, so we need to take this into account and this is why I added the memory palace to the potential project section. It is less lazy than my initial view. How can we do this beyond what Douglas Adams told be about virtual graffiti? How can we share what we see and when would we want to?

## Book Binding

A issue which came up today (4th Feb 2022) is how important it is to have book covers to help use see 'inside' books on our 'shelves'. A binding could including showing a cover and maybe size and depth, if based on a physical book or a book which mimics that. Or the glossary could be what's shown, or the publication date could be key,

We should further be able to write with the full knowledge that we don't know how people will read our work, we are not writing for a printed book or magazine, but to be read in any way the reader wants to read. Or skim. Or sample.

## Book Connections

How should a book be connected to other books we 'own' and books we do not own? How about to books we don't have access to? We can work on different kinds of lines of colours and thicknesses. Maybe also the shape of the book or the collection?

## Hiding data as important is spawning data

I further think that how we show things will be important, but also how we hide things. It's one thing to have a messy desk or wall, but having a messy space in the room, floating, can become pretty intrusive. We should likely look at how we can hide information 'sculptures' as I like to call them. And how to recall them, which may not be the same mechanism every time. For example 'hide this group' and then later 'show everything I have related to this item' which may bring some of the previously hidden data back out.



# A run of questions (probably not worth reading but included for future ref)

## Visually

We will need to start experimenting with what should be shown in this view: icon, title, author(s) or some combination?

And how should we show and hide connecting lines?

## What space

I think we can look at pre-VR environments for inspiration as to what type of activities suit what types of environments and tools. Intimate reading of text probably fits a paperback book because of the size and the ability to hold the book in the fold, which fits our hands well. There would likely be little benefit in reading a novel on a wall size display.

What we have seen quite often though is how large spaces are used for seeing connections, such as a ‘murder wall’ where pictures and text and maps are put up on a wall and lines are drawn or string is hung between items in order for the user to better understand connections. Index cards on a table and large pads of paper have all constituted thinking spaces where the user, or users/participants have worked on seeing and establishing relationships.

When I sit here at my desk in the dining room where I usually work, I do not see a need to remove my 13” laptop for writing or reading, but I do see an enticing situation of being able to look the bookshelf on the other side of the room and choose to have books I have quoted greyed out, click on a citation when I am reading and have the cited book (or Journal article or whatever document) ‘pulled’ towards me for me to have a look at, where that book then gets the ‘hallowed’ position in the rectangle of my laptop (not that it should be a physical laptop screen, it would be great if it floated a bit higher fx). Point is that maybe we should not discard the ‘reading & writing rectangle’ but instead use it as a hub, where what we need close reading of can be ‘docked’ and of course, this rectangle should be possible to dismiss, hide, maybe ‘inside’ a toolkit on my wrist to be called out when I want it or put down on the table. What is this rectangle really? A portal, or a window? Is it a work pad?

This is where we need to start asking what work activity can benefit from such large

and connective views:

- Learning a specific subject or issue with much information being available, such as student learning.
- Trying to understand a situation by studying relevant information where there is no pre-set solution, such as news, academia, business or science.
- Entertainment in the form of social media or news, including doom-scrolling.

We are living at a time when the notion of ‘tools for thought’ has caught attention and I hope it is a step in ‘consumers’ deciding that they need to equip themselves with the tools to help themselves and not only relying on educational, work, government or commercial institutions to do this for them.

I will therefore think about this from the perspective of keeping the rectangle as the centre of most of the users work, with the augmented environment coming into play when required, instantly.

## Interactions

I see interactions being critical with this, as with traditional systems, which is why I developed the Liquid tool which allows the user to select any text and perform any of more than a hundred operations in less than a second and with very little brain power used. I think it will be crucial to develop such a super-power in VR, and I am sure Apple is thinking about this and will make it standard, like the mouse or ctrl-click, but how far can we extend this while keeping it accessible for people to start using it?

- Hide/Reveal extra controls through wrist click, gesture or spoken command and where should options appear, tied to space, relative position of user or on user, such as wrist or around hand?
- Gestures, speech, face expressions even, to move objects, change organisation and so on.

We also have different interactions when focused on a screen: sitting down, and should likely consider that we will want to stand up, but still have the table and chair where it was, when viewing a larger connection space/VR environment. In other words, I think we should

consider designing for standing by table, not sitting (necessarily) or room scale.

## Hand language

Interaction wise I'd like it if we could use right and left hands differently (and ideally reverse for left handed people) so that we can effectively have left and right click. The interaction of having a menu/utility tied to the inside left hand, where the back of a watch would be, is also promising.

## The dimension data problem

Imagine a view which includes a timeline, with any kind of time data on it. How can we 'hold' or 'touch' or 'interact with that timeline to specify that we also want to see a (currently) non-visible dataset (which we will need to somehow specify to a point where the system can produce it) in a specific way? **This a really hard and important problem I think.**

It is (relatively) easy to make a demo with stock data, but I think **the real issue here is getting access to real data and building powerful interactions for the data, serving a real user need.**

So that last one leads me to what I would now like to do with this document: Collaborate with you all in the team on this document and present it in a non-linear form. Linear is fine as a basic 'input' mechanism, I just type and type as I think, but, as I designed for the original Author before the Map became more about learning, I would now really like to pull all the headings of this document out of my rectangle screen and see if anything connects, or maybe just leave it.

I would then like to notify all of you that this is now ready for your input and you can then add and edit as you see fit, in this augmented view, in a way which records who did what.

Crucially I think it's important to then fold all of this back into a document, share it as a traditional document which retains all the VR information.

Therefore I think we should focus on individual and group knowledge work, where we can

work on our own to add and think in a space and then invite in others. We should be able to connect this work to external sources, though links and citations and also to each other's spaces, so that for example one of us could simply 'clip on' their list of professions to the basic list I had on top, which then maybe get longer or shorter depending on what they do on their own.

## Time box?

It seems to me that an initial use case can be viewing the References in useful ways and this will require importing the full Mark ACM Hypertext dataset.

Once we have data in VR, we have to decide on a few initial displays. My feeling is that horizontally stretched box would make sense, going from left to right (x axis) to show occurrences in the document and back to front (z axis) to show publication date, with oldest furthest away. Not sure what to do with the Y axis but I feel that we need to experiment with these axis and that means we'll need some sort of interface to choose what axis shows what, and this might be a useful exercise for us to try to decide what makes sense.

## Value of the computer rectangle display and documents

The reason I think we will benefit from small rectangles for the foreseeable future is that they are personal, if you have only a large space you can't 'read' the information when you are in a social space without 'tuning out'. They are optimal for close reading since we move our eyes and not our heads to focus and they are inherently robust in that this is an optimal form for physical media.

## Game environments

Computer game companies are being bought up to work on VR/metaverse environments and I think we should think in those terms too. We enter a room, it has access to different rooms for different work. I go to my personal space to write this, then I open it up to everyone to comment and shape this 'document' and at the end of the day we fold it back into a format we can share with others, as a basic document and as a hugely augmented VR document, including maybe (externally sorted perhaps) audio and video, such as spoken introduction and animations of our hands guiding someone through what this is.

Adam pointed out this video <https://vimeo.com/670516756> by Raph Koster where he talks about the opportunities of VR as well as the issues with interoperability.

## 'Folders' in thin air...

Once we start putting things in space above our desk we will easily start polluting rather than producing. Being able to have ways of organising this stuff, in something like selections or virtual-virtual folders will become important.

It will also become important to move things, and not just single things, but selections and categories. This is not too super difficult in 2D but in 3D in a very free space where elements can have been (usefully) moved far apart from similar elements, this could become a challenge.

I therefore see a real challenge in how we can somehow 'modify our grip', such as selecting/grabbing an object and indicate that we want to select all of that same type (and what aspect of the object we consider important might determine what 'type' aspect we mean, such as all web pages or all new objects etc.).

This leads me to the current conclusion that objects need to have an origin and home, where they can be returned to. For example, all web pages, or books or Wikidata objects. It should be possible to vacuum them up into origin points to hide them away, or something like that, to make this massively data space manageable.

## Visuals

Organisation will be necessary but it will of course also be necessary to decide what nodes should look like. Should they be dots, text (such as title), or images? Should they show more on proximity or interaction?

**Designing a visual language will be an interesting challenge.**

## Conclusion(s)

How can we build and share knowledge shapes, knowledge sculptures? How can we manage them?

I don't think we should overly focus on one specific task, I think we should work on building what comes after documents: constellations of knowledge brought to bear at will and presented in persuasive forms to others, supporting rich interaction from author and reader.

It should be possible to have a set of documents when working on them, in the air, or stuck to a wall. This should be different from the user's notes and to do items, as well as web pages and transcripts, but it should be possible to move any and all of these elements into other sets—and for the environment to be aware of them—so that the user can perform interactions such as saying (through voice or other interactions) “hide all items made after 1978” should that be of interest.

The user should be able to save/store specific configurations for future access and to share them, where changes made by others will be clearly shown. Much like tracking changes in Word.

Searches should be possible from the Internet but also based on objects selected and the users' information even if not presently shown.

Another stab at a scenario

My favourite scenario? Write this document as I have now, ‘throw it’ into VR space above my laptop, close my laptop. Then re-arrange the headings away from a single column. Look over to my left where my defined terms are and ask to see which are used in this document and attach them if I prefer. Then share this with you all, and you can open this as a stand-alone sculpture to comment on through action or voice, or to add nodes to from your own work. I can imagine Brandel might have many previously written pieces he might want to latch onto something like this. I would then like to start a new space in a meeting with you all where several of you have written something like this and we decide whose to look at and what pieces should be moved into a common sculpture, while staying connected. This way we can build a shape of the Future Text Lab contributor's works and continue working on our own.



## Experiment Lab

This means that we should ideally, if we could afford it, build a VR experiments lab, where many of the settings could be modular and easy to change to test, both interactions (what actions do what) and visuals (various states of objects and groups) as well as how to 'store it away' and how to bring it back.

For example, I can imagine a graph of all of us and each node representing each of us showing some sort of avatar of us and what we are up to (depending on how much we want to share), such as online or offline (greyed out maybe?), new articles published which you have not read yet and so on.

How to Edit this?

Then I ask how I might edit this document in 2D+VR, meaning mostly only laptop but using either additional screens (Immersed style) or full laptop in VR for richer space. What would I like to do? Primarily organise.

So I have added • in the left magic margin so that if I double click on it all the bullet points will be shown in this centre column. A few other terms are in the margins. Being able to fold and unfold bullet lists would be very nice (ctrl-click on a bullet and choose fold or cmd•).

It all becomes a big grey blob of a column too easily. How I can visually indicate different parts for editing easily?

## In sum

What should I do?

The question I have to ask myself is how I can provide the most value in dealing with the purpose of this effort, ‘to communicate the power of working in augmented reality, through building systems and promoting the concept’.

I think about these issues quite a bit and I write about them, in my ebullient style, which is not for everyone, and I like to design software, of which I am proud of Liquid, Author and Reader (and even LiSA and Interactive Globe from long ago) but I have not managed to become successful with the software. I think I need to focus more on the market I should approach, though a deep problem is that it is focused on students but teachers told me in the verification phase of my PhD writeup that teachers are not really interested in student Glossaries. Ouch. And student’s don’t seem to mind the clerical work of producing papers with References. Also ouch.

I have been slightly more successful with the community, particularly the books *The Future of Text* and the Symposium.

What area to work on? What is AR uniquely suited to solve?

The PC had the spreadsheet. The Mac had desktop publishing. What will the killer app for AR/VR be? Social for sure, some games, but what for work? What AR gives is

## Appendix : Who am I?

I feel I must start with the elephant in the room: Who am I to do this? I don't feel I need to ask this for the rest of the members of our team, who are extraordinary.

However, 'battling' against billion dollar companies who has thousands of people working on AR/VR can feel like a real fools errand, a vanity beyond belief. This reality does not absolve me of responsibility to work on this simply because it's too hard or the competition is too well equipped. If the the battle matters, you fight.

Not at all to trivialise their sacrifice but the battle of Stalingrad in world war 2 Russian soldiers were sent across the Volga river with no weapons since their life expectancy was measured in seconds not minutes, and they were expected to find a weapon from a fallen comrade and fight. Who am I to question my position?

I have found it quite depressing on and off the last couple of weeks, I have to be honest I feel. This has been an overwhelming problem and we have an underwhelming amount of resources. I have questioned by own credibility and ability based on what I find to be an extremely lacklustre career, but then I look at the potential of what we can do and the amazing people in our group and take a breath.

Anyway, it was Doug Engelbart who said he was concerned with being asked "who are you to say all these things" even after he invented modern interactive, personal computing, so I can't see getting to the point of enough credibility to matter.

And to quote my other great hero and supporter, Vint, who told me that when he co-invented the Internet protocols, through scoping the problem like an engineer, the solution became obvious. He is not one to boast but I can see how his approach is powerful. We need to focus on the aim and understand the constraints, foster real dialogue and build and show what we can. Simple, in a way. ***In closing this question: Can we afford not to do this?***

# Appendix : Lists

In VR with a full PDF with Visual-Meta, all the elements VM includes will be available:

- Headings
- Glossary
- Endnotes
- Citations placement in body
- Citations in References Section

A break in thinking to list a few professions we might want to augment:

- University student
- Lawyer
- Investigator
- Journalist
- Author
- Scientist
- Teacher
- Business person
- Investor
- Librarian
- Software developer
- Gamers (full games and FPS)
- Gamers (casual or small display, like chess)

Stuff we have available includes:

- Book data
- Journal data (though in a limited form apart from Mark's work)
- Financial data (stocks, currencies)
- Weather information

- Historical news
- Twitter feeds
- Our own dialogue in text (rough) and video and audio forms
- Websites and web searches
- Likely anything Siri can provide
- Maths equations and formulas
- Scientific data
- Wikipedia
- Wikipedia sidebars
- Wikidata
- Laws
- Individual health data/performance
- Instant messages (at least in our own world)

Stuff people need to do to work:

- Maintain To Do Lists (add, update, remove, move, to prioritise)
- Coordinate with other people, related to To Do list
- Think (understand connections: repercussions, causes, relationships, proximity timings etc.)
- Focus
- Research a topic or situation from books, articles or web
- Attend meetings
- Communicate officially (reports, emails, articles)
- Communicate on the fly (messages, phone calls)
- **Collaborate on work and producing work products**

I will therefore also look at what kinds of data we have available to play with, to help with my thinking:

- Time/Date for weather, financial, social and other time-known events
- Documents/Books/Web pages to cite and to check citations of
- People, either historical, current, in person or in bulk, or colleagues

- Transcripts and meeting notes/videos
- Available scientific and academic data

# Glossary

**"academic"** someone who reads academic documents, usually associated with an academic institution, but not necessarily.

**"ACM"** From Wikipedia: “The Association for Computing Machinery (ACM) is a US-based international learned society for computing. It was founded in 1947 and is the world's largest scientific and educational computing society.”

[https://en.wikipedia.org/wiki/Association\\_for\\_Computing\\_Machinery](https://en.wikipedia.org/wiki/Association_for_Computing_Machinery)

ACM's 'Hypertext' Conference piloted Visual-Meta in 2021.

**"Addressability"** refers to how something can refer to something else. In the digital world this primarily means in a local file structure and a server based network. In academia it can refer to citation or references. In the physical world it can refer to a formal location layout, such as a flat so and so in house so and so, as well as coordinates. It can also mean relative addressing, such as saying take a left after the third yellow house.

**"Annual Symposium"** hosted annually by Frode Hegland.

Frode Hegland sees this as level C of Doug Engelbart's Three Levels of Activity.

**"AR"** “Augmented reality (AR) is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory.”

[https://en.wikipedia.org/wiki/Augmented\\_reality](https://en.wikipedia.org/wiki/Augmented_reality)

AR includes the real reality, as opposed to VR which does not.

**"ARC"** Engelbart Concept: Augmentation Research Center, The name of Doug's lab at SRI where he

proposed a system called H-LAM/T in 1962 and developed and in 1968 demonstrated NLS: oNLine System, his platform for shared knowledge work research, later renamed Augment and from which I decided on the name Author, since Author and Augment share etymological roots.

**"Augmented Copy"** is what we call the method of copying text from one location and pasting it with additional metadata, such as high-resolution addressing and citation information. It primarily uses BibTeX formatting.

**"Augmented Text Company"** The company which produces these tools.

<https://www.augmentedtext.info>

**"Author"** is my word processor for macOS, maybe later for iOS, which produces PDF's with Visual-Meta for any PDF viewer but which my Reader PDF viewer can parse to give the user rich interactions. It is produced by my small, independent software development company The Augmented Text Company LTD, with programming by Jacob Hazelgrove.

<https://www.augmentedtext.info>

**"AUTHOR"** a word processor from the Augmented Text company.

<https://www.augmentedtext.info/author>

**"BibTeX"** is a specific format for conveying citation information within the LaTeX environment, developed by Oren Patashnik and Leslie Lamport, released in 1985. The benefit of the system was to separate citation information from presentation style and it is human readable, though it slightly looks like code. It inspired the format of Visual-Meta and Visual-Meta contains a straight BibTeX section to allow the document which contains it to be cited.

**"Bootstrapping"** Doug Engelbart Notion.: The act of co-evolving the tool and human systems to make better tools and systems, thus pulling us up by our bootstraps. (For an overview, see the Bootstrap Paradigm Map). This is done on three levels of activity.



**"Citation Standards"** are used in academia to allow a reader to find a work external to the currently read work, through a description of the work, including, but not limited to, title, author(s), publication date, DOI, URL, location and so on.

**"Co-Evolution"** Doug Engelbart Notion: Most capabilities are improved, or augmented, by many interdependent technical and non-technical elements, of which tools make up only a small part: On one hand, there is the human system, which includes paradigms, organizations, procedures, customs, methods, language, attitudes, skills, knowledge, training and so on- all of which all exists within the basic perceptual and motor capabilities of the human being. On the other hand, there is the tool system, which includes media, computers, communications systems etc. Together, they comprise the augmentation system

**"CoDIAK"** Doug Engelbart Notion: CoDIAK (Concurrent Development, Integration, and Application of Knowledge) process aligns with the academic process of publishing and referring to published sources, though in his version there is considerably more speed and interactive options. He believed passionately in the notion of a Collective IQ.

Our capability for dealing with complex, urgent problems-i.e., “to understand them adequately, to unearth the best candidate solutions, to assess resources and operational capabilities and select appropriate solution commitments, to be effective in organizing and executing the selected approach, to monitor the progress and be able to adjust rapidly and appropriately to unforeseen complications, etc.” in Augmenting society's collective IQs

**"Collective IQ"** Doug Engelbart Notion: A measurable group intelligence and the need for improving how we think together.

**"colophon"** a publisher's emblem or imprint, usually on the title page of a book which inspired Visual-Meta, which is similar data, in BibTeX form, at the back of a document.

**"concept, defined concept, defined concepts"** means, in this context, my experiment with useful

units of thought or knowledge, which can be defined in Author, hopefully soon in Reader. Stored as text.

The Map view uses the definition to draw lines where text from a definition is also present on the Map.

When a document is exported to PDF the Defined Concepts become Glossary Terms.

This is as opposed to inferred concept.

Also aView in Author and in Reader (with Visual-Meta) to show all named entities (and headings).

**"Dame Wendy Hall, Wendy Hall"** Frode Hegland's PhD primary supervisor, along with Les Carr and David Millard.

**"David Millard"** Frode Hegland's PhD supervisor, along with Dame Wendy Hall and Les Carr.

**"DOI"** Document Object Identifiers. An effort to make addressing academic documents via the web more robust.

Used in Author to let the user paste a DOI to cite an academic document which is then sent to CrossRef to be parsed into BibTeX which is then used to create a full citation.

**"Doug Engelbart, Douglas Carl Engelbart, Doug"** From Wikipedia: "He was an engineer and inventor, and an early computer and Internet pioneer. He is best known for his work on founding the field of human-computer interaction, particularly while at his Augmentation Research Center Lab in SRI International, which resulted in creation of the computer mouse, and the development of hypertext, networked computers, and precursors to graphical user interfaces. These were demonstrated at The Mother of All Demos in 1968. Engelbart's law, the observation that the intrinsic rate of human performance is exponential, is named after him."

He was also my mentor and greatly influenced my work, resulting in my company called The Augmented Text Company and my word processor being called Author, in honour of his 'Augment' system. Visual-Meta is inspired by his Open Hyperdocument work.

**"Find"** View in Author and in Reader (with Visual-Meta) where the user can see only the sentences

with keyword.

**"Folded"** View in Author and in Reader (with Visual-Meta) where the user can fold the document into an outline.

**"Frode Hegland"** Director of the Future Text Lab (FTL) <https://futuretextlab.info>

Director of The Augmented Text Company where he designed the macOS Author word processor, Reader PDF viewer and the Liquid text interaction tool.

<https://www.augmentedtext.info/>

Editor of the 'The Future of Text' series of books and Journal, which will be the basis of future 'The Future of Text' volumes.

Hosts 'The Future of Text Symposium' annually, starting 2011.

Designed Visual-Meta.

His mentor was Doug Engelbart and influenced by Ted Nelson.

**"Glossary"** means, in the context of this work, terms and definitions in a 'Glossary' Appendix in a document.

This can be created in Author as a Defined Term which is then exported as a Glossary and included in Visual-Meta.

Reader can parse the glossary terms in the Visual-Meta and make them interactive.

This is different from a dictionary since dictionary definitions have general validity and Glossary terms only aim to express the author's point of view.

Defined Concept becomes Glossary Term when exported from Author to PDF.

Inspired by discussions with Doug Engelbart.

**"Glossing"** A way of elucidating parts of text.

<https://www.etymonline.com/search?q=gloss>

**"Hamilton"** a musical by Lin-Manuel Miranda which has influenced Frode Hegland greatly. The real person is also an inspiration since he used the power of text to write a new society into existence.

I use Hamilton in presenting the Map and Defined Concepts in Author since it's a fun and easy way to present the one-way relationship.

**"high-resolution addressing"** A Doug Engelbart Notion: Being able to link to/address/cite specific parts of a document, not just the document as a whole.

**"hypertext"** a term invented by Ted Nelson for interactive and connected digital text. Today it is very much about clicking on links but in Ted's early work it was all about freedom for the user.

**"in-body citation"** in this context, this refers to the citation in the body of the document.

In contrast, 'Reference' with uppercase 'R' refers to the appendix in an academic document which lists cites sources.

**"Inferred Concept"** are concepts extracted through human or machine means. Such as simply taking sentences which start with something 'is' and then using that as an inference that the writer meant that as a concept. This is as opposed to a defined concept.

**"Ismail Serageldin"** is a friend and supporter of Frode Hegland. They first met at the Science & Technology Forum in Japan quite a few years ago.

He is Egyptian, Founding Director of the Bibliotheca Alexandrina (BA) and was Vice President of the World Bank.

**"Jacob Hazelgrove"** Programmer for all Augmented Text tools for Frode Hegland, including Author and Reader, as well as imlementor of Visual-Meta export from Author and import and interaction in Reader.

**"JATS"** "Journal Article Tag Suite (JATS) is an XML format used to describe scientific literature

published online.”

[https://en.wikipedia.org/wiki/Journal\\_Article\\_Tag\\_Suite](https://en.wikipedia.org/wiki/Journal_Article_Tag_Suite)

**"Les Carr, Leslie Carr"** Frode Hegland's PhD supervisor, along with Dame Wendy Hall and David Millard.

**"LIQUID"** A text interaction tool from the Augmented Text company. It can be used in Author, Reader and most macOS applications.

<https://www.augmentedtext.info/liquid>

**"manuscript"** the authoring format, such as Microsoft Word, which is then either shared as-is, and stays editable, or is exported to be published in a publish format, such as PDF.

**"map"** View in Author.

Here the user can place text anywhere they want.

If there are defined concepts on the map, the user can click on them and lines will emanate to any text on the map which is in that text's definition.

**"metadata"** information about other information, in the case of documents, this can include structural information (headings for example), how they connect to other documents (References) and who created the document (self-citing)

**"Names"** View in Author and in Reader (with Visual-Meta) to show all named entities (and headings).

**"NIC"** Engelbart Concept: Networked Improvement Community “Consider an "Improvement Community" (IC) as collectively engaged in improving an agreed-upon set either of individual capabilities, or of collective group capabilities-e.g. a professional society. Let's introduce a new category, a "Networked Improvement Community" (NIC): an IC that is consciously and effectively

employing best-possible DKR (Dynamic Knowledge Repository) development and usage.”  
(augmenting society's collective IQ).

**"NLS"** From Wikipedia: “NLS, or the "oN-Line System", was a revolutionary computer collaboration system developed in the 1960s. Designed by Douglas Engelbart and implemented by researchers at the Augmentation Research Center (ARC) at the Stanford Research Institute (SRI), the NLS system was the first to employ the practical use of hypertext links, the mouse, raster-scan video monitors, information organized by relevance, screen windowing, presentation programs, and other modern computing concepts. It was funded by ARPA (the predecessor to Defense Advanced Research Projects Agency), NASA, and the US Air Force.” [https://en.wikipedia.org/wiki/NLS\\_\(computer\\_system\)](https://en.wikipedia.org/wiki/NLS_(computer_system))

SRI sold NLS to Tymshare in 1977 and renamed it Augment.

**"Open Office Hours"** I host an hour on Zoom every Monday and Friday at 4pm UK time for a community of people who are interested in The Future of Text. They have so far really helped polish Visual-Meta and provide thoughtful dialogue.

**"paper"** is a general term for a student or academic document in general.

Primarily in PDF when published or handed in.

In manuscript/editable/personal form it is generally in the Microsoft Word format.

**"PDA"** ‘Personal Digital Assistant’. This was before smartphones.

**"PDF"** Portable Digital Format developed by Adobe and now license free. It is an export format rather than a manuscript/working format.

**"PDF"** ‘Portable Digital Format’ developed by Adobe, now free with no license restrictions. It is a print to digital medium with few digital affordances which my work on Visual-Meta expands to allow for users to interact with the document in useful ways, while staying compatible with the basic PDF

format.

**"PDF with Visual-Meta"** PDF with Visual-Meta to allow Reader software to provide richer interactions for the user.

**"Reader"** is my minimalist PDF viewer for macOS, soon also for iOS, which can read any PDF and can provide added interactions if the PDF has Visual-Meta attached, which can either be produced by Author or any other word processor with Visual-Meta capability, or downloaded from an online repository which features Visual-Meta, such as the ACM digital library.

It is produced by my small, independent software development company The Augmented Text Company LTD, with programming by Jacob Hazelgrove.

<https://www.augmentedtext.info>

**"References"** is a list of all the citations a document uses, in an Appendix. In-Body citation, point to these References. This language is not fixed, it is sometimes used interchangeably with Bibliography but in my context a Bibliography is a list of work not expressly cited but which are relevant. in this context 'Reference' with uppercase 'R' refers to the appendix in an academic document which lists cites sources. In contrast, the citation in the body of the document is referred to as in-body citation.

**"Research Question"** RQ 1) How can rich interactions be enabled through rich metadata in PDF documents?

RQ 2) How do such rich interactions change the experience of the users, particularly, what interactions are useful?

RQ 3) What are the opportunities and barriers for wide adoption of such a system in education and research?

**"Scoping Survey"** was a survey in 2019 to better understand the needs of the academic community, carried out at The University of Southampton.

**"Sparklines"** From Wikipedia: "A sparkline is a very small line chart, typically drawn without axes or coordinates. It presents the general shape of the variation (typically over time) in some measurement, such as temperature or stock market price". originally invented by Laurnce Sterne in the 1700's.

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

**"Student"** for my work, the student is the primary user of Author for writing and Reader for reading.

**"Teacher"** in this context it the primary reader of a student paper.

**"Ted Nelson, Theodor Holm Nelson"** coined the term 'hypertext'.

**"Text"** is the basic 'stuff' of this work.

**"The Future of Text"** A series of symposia and books under the name 'The Future of Text' produced by the same people who run The Augmented Text Company.

<https://futuretextpublishing.com>

**"The Future of Text Vol 1&2"** Annual book series edited and published by Frode Hegland as part of The Future of Text.

Frode Hegland sees this as level C of Doug Engelbart's Three Levels of Activity.

**"Three levels of activity"** Engelbart Notion: A,B & C levels of activity are levels of work activity in the bootstrapping process:

(improving our ability to improve: a call for investment in a new future)

A level is the the work activity of the organization

B level is the activity of improving A, such as adding technological tools or improved work processes

C level is the activity of improving how we improve, something best done across organizations, in a



NIC.

**"ViewSpec"** Engelbart Notion: View Specifications for a user to see their work in different views to gain new perspectives and to navigate their document.

**"Vint Cerf, Vinton Gray Cerf, Vinton G. Cerf"** Co-inventor of the Internet, VP and Chief Internet Evangelist for Google. Chairman of the Marconi Society. Former executive at MCI, the Corporation for National Research Initiatives, the Internet Corporation for Assigned Names and Numbers (ICANN), the American Registry for Internet Numbers (ARIN), the Association for Computing Machinery (ACM) and member of the Faculty of Stanford University. Fellow of IEEE, ACM, BCS, AAAS, American Academy of Arts and Sciences, and American Philosophical Society. Member of the US National Academies of Engineering and Science and foreign member of the Royal Society and the Royal Swedish Engineering Society.

He has been a strong and vocal supporter of Frode Hegland's work, and Visual-Meta in particular.

**"Visual-Meta"** is my approach for embedding metadata in documents, initially PDF, to allow viewer software to provide rich interactions. The Visual-Meta is added as an appendix to the end of the document in a format inspired by BibTex.

<http://visual-meta.info>

**"vm-id"** The ID of the document is the Visual-Meta ID which is created like this:

{2021-7-17T18:00:00Z/documentti} < start with date and time the document's metadata/Visual-Meta was 'created' (in UTC), then the first 10 characters of the document title, or less.

(In the ACM pilot is simply the DOI: vm-id = {doi10.1145/3372923.3404798})

OR like this, if the Visual-Meta was appended by reader software rather than added on creation:

{appended-hash-sha256-98765435678987654;reader(3.0)} < For documents which are already created (without Visual-Meta) where the reader software appends a vm-d for future reference. It is a hash of original PDF before Visual-Meta page is added, using a sha256 of the raw string value of the document, followed by the name and version of the software appending the vm-id.

**"xFiles"** Engelbart Notion: xFiles were intermediary file system for the Open Hyperdocument System (OHS) to serve as a Dynamic Knowledge Repository (DKR).

# Endnotes

<sup>a</sup> <https://www.interaction-design.org/literature/article/augmented-reality-the-past-the-present-and-the-future>

<sup>b</sup> <https://www.dummies.com/article/technology/programming-web-design/general-programming-web-design/the-history-of-virtual-and-augmented-reality-256104>

<sup>c</sup> <https://www.apple.com/uk/augmented-reality/>

<sup>d</sup> Apple is creating devices it hopes users will use in small, purposeful bursts, rather than constant mindless drifting.

<https://www.pcgamer.com/uk/apples-upcoming-ar-headset-may-limit-users-to-short-bursts/>

## References

Engelbart, C., *Augmenting Human Intellect*. 1962. <https://dougengelbart.org/content/view/138#9>.  
[Accessed 04 02 2022].

Lanier, J. 2018. *Dawn of the New Everything*. Picador. ISBN: 1250097401, 9781250097408. <http://play.google.com/books/reader?id=wNgotAEACAAJ>.

# Visual-Meta Appendix

The information in very small type below allows software to provide rich interactions with this document. See [Visual-Meta.info](https://visual-meta.info) for more information.

This is what we call Visual-Meta. It is an approach to add information about a document to the document itself on the same level of the content. The same as would be necessary on a physically printed page, as opposed to a data layer, since this data layer can be lost and it makes it harder for a user to take advantage of this data. ¶ Important notes are primarily about the encoding of the author information to allow people to cite this document. When listing the names of the authors, they should be in the format 'last name', a comma, followed by 'first name' then 'middle name' whilst delimiting discrete authors with ' and ' between author names, like this: Shakespeare, William and Engelbart, Douglas C. ¶ Dates should be ISO 8601 compliant. ¶ The way reader software looks for Visual-Meta in a PDF is to parse it from the end of the document and look for @ [visual-meta-end]. If this is found, the software then looks for @ [visual-meta-start] and uses the data found between these marker tags. ¶ It is very important to make clear that Visual-Meta is an approach more than a specific format and that it is based on wrappers. Anyone can make a custom wrapper for custom metadata and append it by specifying what it contains. For example @dublin-core or @rdfs. ¶ This was written Summer 2021. More information is available from <https://visual-meta.info> or from emailing [frode@hregland.com](mailto:frode@hregland.com) for as long as we can maintain these domains.

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ACM's Hypertext Conference spawned Visual-Meta in 2021.],
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https://en.wikipedia.org/wiki/Augmented_reality]
AR includes the real reality, as opposed to VR which does not.],
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(Used in Author to let the user paste a DOI to cite an academic document which is then sent to Crossref to be parsed into BibTeX which is then used to create a full citation. ),
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https://www.augmenttext.info/
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Hosts 'The Future of Text Symposium' annually, starting 2011. ¶
Designed Visual-Meta ¶
His mentor was Doug Engelbart and influenced by Ted Nelson. ],
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This is different from a dictionary since dictionary definitions have general validity and Glossary terms only aim to express the author's point of view. ¶
Defined Concept becomes Glossary Term when exported from Author to PDF. ¶
Inspired by discussions with Doug Engelbart. ¶
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name = [NIC], description = [Engelbart Concept: Networked Improvement Community "Consider an "Improvement Community" (IC) as collectively engaged in improving an agreed-upon set either of individual capabilities, or of collective group capabilities-e.g. a professional society. Let's introduce a new category, a "Networked Improvement Community" (NIC) an IC that is consciously and effectively employing best-possible DKR (Dynamic Knowledge Repository) development and usage."
(augmenting society's collective IQ).]
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name = [NLS], description = [From Wikipedia: "NLS, or the "on-Line System", was a revolutionary computer collaboration system developed in the 1960s. Designed by Douglas Engelbart and implemented by researchers at the Augmentation Research Center (ARC) at the Stanford Research Institute (SRI), the NLS system was the first to employ the practical use of hypertext links, the mouse, raster-scan video monitors, information organized by relevance, screen windowing, presentation programs, and other modern computing concepts. It was funded by ARPA (the predecessor to Defense Advanced Research Projects Agency), NASA, and the US Air Force." https://en.wikipedia.org/wiki/NLS_(computer_system)#SRI_sold_NLS_to_Tymshare_in_1977_and_renamed_it_Augment.].]
@entry
name = [Open Office Hours], description = [I host an hour on Zoom every Monday and Friday at 4pm UK time for a community of people who are interested in The Future of Text. They have so far really helped polish Visual-Meta and provide thoughtful dialogue.]
@entry
name = [paper], description = [is a general term for a student or academic document in general.
Primarily in PDF when published or handed in.
In manuscript/personal form it is general in the Microsoft Word format.]
@entry
name = [PDA], description = [Personal Digital Assistant'. This was before smartphones.]
@entry
name = [PDF], description = [Portable Digital Format develop by Adobe and now license free. It is an export format rather than a manuscript/working format.]
@entry
name = [PDF], description = [Portable Digital Format developed by Adobe, now free with no license restrictions. It is a print to digital medium with few digital affordances which my work on Visual-Meta expands to allow for users to interact with the document in useful ways, while staying compatible with the basic PDF format.]
@entry
name = [PDF with Visual-Meta], description = [PDF with Visual-Meta to allow Reader software to provide richer interactions for the user.]
@entry
name = [Reader], description = [is my minimalist PDF viewer for macOS, soon also for iOS, which can read any PDF and can provide added interactions if the PDF has Visual-Meta attached, which can either be produced by Author or any other word processor with Visual-Meta capability, or downloaded from an online repository which features Visual-Meta, such as the ACM digital library.
It is produced by my small, independent software development company The Augmented Text Company LTD, with programming by Jacob Hareldgrove.
https://www.augmenttext.info/]
@entry
name = [References], description = [is a list of all the citations a document uses, in an Appendix. In-Body citation, point to these References. This language is not fixed, it is sometimes used interchangeably with Bibliography but in my context a Bibliography is a list of work not expressly cited but which are relevant.
In this context "Reference" with uppercase "R" refers to the appendix in an academic document which lists cites sources. In contrast, the citation in the body of the document is referred to as in-body citation.]
@entry
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RQ 2) How do such rich interactions change the experience of the users, particularly, what interactions are useful?
RQ 3) What are the opportunities and barriers for wide adoption of such a system in education and research?].]
@entry
name = [Scoping Survey], description = [was a survey in 2019 to better understand the needs of the academic community, carried out at The University of Southampton.]
@entry
name = [Sparkline], description = [From Wikipedia: "A sparkline is a very small line chart, typically drawn without axes or coordinates. It presents the general shape of the variation (typically over time) in some measurement, such as temperature or stock market price", originally invented by Laurence Sterne in the 1700s."
https://en.wikipedia.org/wiki/Sparkline].]
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name = [Student], description = [for my work, the student is the primary user of Author for writing and Reader for reading.]
@entry
name = [Teacher], description = [in this context it the primary reader of a student paper.]
@entry
name = [Ted Nelson], al-name1 = [Theodor Holm Nelson], description = [coined the term "hypertext"].]
@entry
name = [Text], description = [is the basic 'stuff' of this work.]
@entry
name = [The Future of Text], description = [A series of symposia and books under the name "The Future of Text" produced by the same people who run The Augmented Text Company.
https://futuretextpublishing.com/]
@entry
name = [The Future of Text Vol 1&2], description = [Annual book series edited and published by Frode Hegland as part of The Future of Text.
Frode Hegland sees this as level C of Doug Engelbart's Three Levels of Activity.]
@entry
name = [Three levels of activity], description = [Engelbart Notion: A,B & C levels of activity are levels of work activity in the bootstrapping process:
(improving our ability to improve: a call for investment in a new future)
A level is the work activity of the organization.
B level is the activity of improving A, such as adding technological tools or improved work processes.
C level is the activity of improving how we improve, something best done across organizations, in a NIC.].]
@entry
name = [ViewSpec], description = [Engelbart Notion: View Specifications for a user to see their work in different views to gain new perspectives and to navigate their document.]
@entry
name = [Vint Cerf], al-name = [Vinton Gray Cerf], al-name2 = [Vinton G. Cerf], description = [Co-inventor of the Internet, VP and Chief Internet Evangelist for Google, Chairman of the Marconi Society, Former executive at MCI, the Corporation for National Research Initiatives, the Internet Corporation for Assigned Names and Numbers (ICANN), the American Registry for Internet Numbers (ARIN), the Association for Computing Machinery (ACM) and member of the Faculty of Stanford University, Fellow of IEEE, ACM, IBCS, AAAA, American Academy of Arts and Sciences, and American Philosophical Society. Member of the US National Academies of Engineering and Science and foreign member of the Royal Society and the Royal Swedish Engineering Society.
He has been a strong and vocal supporter of Frode Hegland's work, and Visual-Meta in particular.]
@entry
name = [Visual-Meta], description = [is my approach for embedding metadata in documents, initially PDF, to allow viewer software to provide rich interactions. The Visual-Meta is added as an appendix to the end of the document in a format inspired by BibTex.
http://visual-meta.info/]
@entry
name = [vnm-id], description = [The ID of the document is the Visual-Meta ID which is created like this:
[2021-7-17T18:00:00.00Z/document] < start with date and time the document's metadata/Visual-Meta was 'created' (in UTC), then the first 10 characters of the document title, or less.
(In the ACM pilot is to simply the DOI: vnm-id = [doi:10.1145/372922.3404798].
OR like this, if the Visual-Meta was appended by reader software rather than added on creation.
[appended-hash-sha256-9876543210987654.reader(3.0)] < For documents which are already created (without Visual-Meta) where the reader software appends a vnm-id for future reference. It is a hash of original PDF before Visual-Meta page is added, using a sha256 of the raw string value of the document, followed by the name and version of the software appending the vnm-id.]
@entry
name = [xFiles], description = [Engelbart Notion: xFiles were intermediary file system for the Open Hyperdocument System (OHS) to serve as a Dynamic Knowledge Repository (DKR).]
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