

The Chain Gang & Information Delivery: only as good as its weakest link.

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Abstract:

This thoughtful provocative paper examines the complex links between producers and consumers of electronic information. It highlights the difficulties involved in providing seamless access to electronic resources and for managing consumer expectations. Many librarians feel a loss of control over their ability to perform traditional service roles due to turbulent changes in scholarly information. Strategies for regaining control include identification of where failures occur, determining responsibility across the links in the chain, and communicating this information quickly to the consumer. These strategies will assist librarians in maintaining a realistic service level for consumers of electronic products in the Hybrid Library.

Prologue: The Chain Gang

This paper presents two choices for the future of electronic information delivery: chaos or anarchy. Our aim is to highlight some of the myths and realities in the chain of connections between producers and consumers of electronic information. At a time when library user expectations are moving rapidly to a situation where only screen-based knowledge is valued, the reality for many users is that it may take much longer to get something electronically via a computer than it would to get the paper and ink relic from the shelves.

We aim to show that the recognition of this situation, along with the provision of adequate information about the availability of these resources, is a critical strategy for dealing with the knowledge consumer's expectations. This may at least ensure we continue to provide beneficial, value-added library services in an industry teetering somewhere between chaos and anarchy.

Despite the rhetoric of inevitability that the world will shortly become a large 'paperless office', and that libraries will be 'virtual' within 5-10 years, the reality after five years of the web revolution seems quite different. No longer do librarians and other commentators talk about a radical shift from the Library to the Cybrary but instead are now talking about the Hybrid Library, which we will call the Hybrary.

The e-revolution has already had a massive impact on information transfer. The concept of the hybrary recognises the reality that all librarians, or hybrarians, have continued to express caution over: that libraries as we know them are, and will probably always be, a conglomerate of information resources published in a variety of formats. The hybrary provides access to paper and ink publications, microforms, audio, video, prints, pictures, CD-ROMs, computer files, and increasingly, digital information resources such as electronic books and journals, web sites, databases, digital images, digital audio and video.

The future will no doubt turn up even more useful technologies for storing and transferring information and knowledge.

Our role as hybrarians is to manage all these formats as we pursue our abiding value-added activities that benefit our communities: we **Select** information resources, we provide **Physical Access** to those resources, and most importantly we provide **Intellectual Access** to those resources. Format is irrelevant. Most hybrary users, or knowledge consumers, simply want to get the information in the quickest and most useable form for their needs. In addition, knowledge consumers, especially academics, want to know the real options connected to formats in order to make rational decisions about what they recommend to their libraries for purchase, and what cost and time factors need to be considered when deciding on which format to pursue.

Consumers use all types of formats and will continue to do so, depending on their understanding of what is available and the likely time and cost involved in obtaining a copy. Despite the possibility that it can sometimes take longer to obtain a copy of an electronic title there is still a preference for e-resources. For some reason the user seems to value them more and be prepared to spend more time searching and waiting. One of the main reasons is that the convenience of remote or off-campus use will often outweigh the negatives of having all the right connections. The hope (or is it hype) is that all the links between user and supplier are in fact all working simultaneously. This may be a false hope.

Datalogue: perceptions of expectations of information delivery in hybraries

Table 1. below shows that knowledge consumers and library management in particular tend to perceive, interpret and overemphasise the smooth links in the chain of connections required for ensuring access to e-information. They expect access to be fast, 100% reliable, easy, and cost-effective. This expectation might be due to a number of reasons, for both groups:

- the desire to accept the hype created by suppliers and the mass media that the virtual library is just around the corner
- the new competitiveness of the education sector that drives senior managers to demonstrate cutting-edge developments in their libraries
- the difficulty of understanding fully and precisely the links in the chain
- the underestimation of the amount of additional resources required to ensure the maintenance of the complex processes necessary to link supplier with consumer
- the desire by librarians to take advantage quickly of the new technologies of the Digital Age

The table is a model of the various factors and processes involved in obtaining information in the both paper and electronic formats. It represents the authors' formulations based on front line service experience. Column 1 lists the steps involved for both formats. Some of these steps can be further specified – eg '**link to full text title**' in the e-journal alternative invariably involves many linking processes, which we explore in the case study below. Columns 2-5 list the indicators of hybrarians' perceptions of these steps on a simple three-scale measure. Column 6 integrates the individual indicators for Columns 2-5. We will call this the reality meta-indicator, and represents the hybrarian's overall perception regarding their expectation of information delivery. This counterpoints the same overall perception of knowledge and information consumers and/or managers in Column 7.

Table 1. Comparing perceptions, expectations and realities of information delivery in hybraries

Case A: Getting a printed copy of an article from a print journal

| 1. | 2. | 3. | 4. | 5. | 6. | 7. |
|------------------------------------|--------|-------------|-------------|--------|---------|------------|
| Steps | Time | Reliability | Ease of use | Cost | Reality | Perception |
| <i>go to library</i> | slow | high | varies | high | varies | high |
| <i>find catalogue</i> | varies | high | varies | low | varies | high |
| <i>find stack</i> | slow | varies | varies | medium | varies | high |
| <i>find journal title in stack</i> | slow | varies | varies | medium | varies | high |
| <i>find issue</i> | fast | high | easy | medium | medium | high |
| <i>find article</i> | fast | high | easy | high | varies | high |
| <i>find photo-copier</i> | fast | high | easy | medium | varies | high |
| <i>copy article</i> | varies | varies | easy | medium | varies | medium |

Case B: Getting a print copy of an article from an e-journal

| 1. | 2. | 3. | 4. | 5. | 6. | 7. |
|---|--------|-------------|-------------|--------|---------|------------|
| Steps | Time | Reliability | Ease of use | Cost | Reality | Perception |
| <i>find computer</i> | varies | varies | varies | varies | varies | medium |
| <i>find catalogue</i> | varies | high | varies | low | varies | high |
| <i>find journal title in catalogue</i> | varies | varies | varies | medium | varies | high |
| <i>link to full text title from catalogue</i> | varies | varies | varies | low | varies | low |
| <i>find issue</i> | varies | varies | easy | varies | varies | low |

| | | | | | | |
|---------------------|--------|--------|--------|--------|--------|-----|
| <i>find article</i> | varies | varies | varies | varies | varies | low |
| <i>download</i> | varies | varies | varies | varies | varies | low |
| <i>print copy</i> | varies | varies | varies | varies | varies | low |

Column 1: Steps required

Column 2: Perception of time needed (slow/medium/fast)

Column 3: Perception of reliability (low/medium/high)

Column 4: Perception of ease of use (easy/medium/difficult)

Column 5: Perception of cost (time and/or money) of information (low/medium/high)

Column 6: Overall indicator of access (reality meta-indicator) (low/medium/high)

Column 7: Consumer/manager perception of access (low/medium/high)

The contrast between the perception and reality for knowledge/information consumers and/or senior organisational decision makers is sobering. The latter are under severe competitive pressures, often caught up in the treadmill of promotion, as they strive to preserve their position at the front line.

One hundred percent reliability of connectivity is of course an illusion. The paradigm is willing but the reality is weak. Knowledge consumers and hybrarians all realise the convenience of desk top delivery, even if it is not their own desk top. Academics and librarians accept the benefits of the shift to web based learning and the prospect of the asynchronous reproduction of information across the world wide hybrary. These are noble strategies supported by a high level of enthusiasm and commitment. But what is the reality? Let us have a look in more detail at just one set of links in the chain.

Dialogue: missing links

Case study 1: an Inside job

Let us focus on an example that illustrates how difficult it can be for the last link in the information chain - the hybrary that delivers the information to the consumer sitting at the computer expecting the knowledge pearls to appear in graphical glory on the screen in front of them.

The example attempts to tease out the trail of the information packets as they wend their way from the host computer to their final resting place on the consumer's screen, hard disk or sheet in the printer's paper tray.

Our story starts with the consumer doing their best to obtain an article from the *Journal of Irretrievable Results*. They've been told that the article is in a journal that the hybrary doesn't hold, but that there is this wonderful new system where they can go to the hybrary, or, even better, just click on the Hybrary's web page and order the article online, and they can choose to have it sent by fax within 2 hours. Sounds good. Sounds like an Inside job. And that's where it turns out they end up looking - on the British Hybrary's Inside database. After some difficulty - they don't find the Inside database as easily as they thought they would on the Hybrary's homepage and they

even have to ring up and ask a hybrarian, which is very awkward because they've only got one telephone line and they have to get off the 'net to ring up ...

Finally, they click on the magic Inside link ...

.... and wait and wait..... and wait..... and wait..... and wait. And wait.

The browser hourglass is OK. But nothing much else. Gradually the page appears, pixel by pixel, out of the shimmering mist of the digital desert. The consumer begins to think they could have flown to Britain in this time, photocopied the article, called on Her Majesty for tea, successfully stood for parliament, passed a law banning outrageous service claims by inefficient newly privatised agencies such as the British Hybrary and ...

However, they decide that they'll kick the nearest thing to hand ... the friendly hybrarian who 'sold' Inside to them in the first place.

The hybrarian has a myriad strategies and choices of response. Which one do they choose? Here is a sample ...

1. ***It might be the user's computer is just not up to accessing the javascript-dependent Inside site.***

The hybrarian considers this, and then thinks that maybe they should check whether they can get at the service from where they are, from their own machine - which is entry level powerful. Sure enough it's painfully slow getting ... Inside.

2. ***Perhaps the authentication mechanism is breaking down - the Hybrary has an elaborate method of authenticating people accessing the Hybrary's datasets from non-University Internet Service Providers (ISP) locally before referring them on via a proxy that brings them within the IP-range.***

The hybrarian considers this, but rejects this approach, as they are having equal difficulty accessing Inside from on campus itself.

3. ***It could be that the 'other end' is not working - i.e. The British Hybrary itself.***

Aaah - this is more likely, thinks the hybrarian. Difficult to reach a conclusion on this one. The hybrarian rings the local Inside agent in Melbourne (another city). Are they having trouble? None at all - normal speed ...

4. ***Maybe there's trouble on the local telecommunications connections to and from the 'net.***

Unlikely, thinks the hybrarian, as the consumer is accessing the 'net from another ISP. On the other hand they are being re-channeled via the hybrary's local proxy. Uncertain, the hybrarian decides to check another site in the UK - somewhere near the British Hybrary. No problem there, though. Normal, uninterrupted transmission.

5. ***Maybe ...maybe ...maybe.***

The librarian is running out of ideas. They decide on a last resort - the local 'techie'.

A ponytail grunts out of a bunker somewhere, monosyllabically peers at the screen, sits down and starts pecking the keyboard furiously.

Soon Figure 1 appears on the screen:

Figure 1:

Trace of the route from the Hybrary to the British Hybrary Inside service 4th August 1999

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Tracing route to voyager.bl.uk [194.66.233.20]
over a maximum of 30 hops:

 1    1 ms    1 ms    1 ms    nungw.nun.unsw.edu.au [149.171.40.1]
 2    1 ms    1 ms    2 ms    129.94.6.129
 3    2 ms    1 ms    1 ms    nswrno2-atm4-0-ultimo.nswrno.net.au
      [203.15.123.37]
 4    4 ms    4 ms    3 ms    atm2-0-3.sb1.optus.net.au [192.65.88.245]
 5    4 ms    3 ms    4 ms    atm5-0-0-12.ia4.optus.net.au [192.65.89.209]
 6    4 ms    6 ms    3 ms    atmsr-1-10.ap1.optus.net.au [202.139.7.57]
 7   687 ms  674 ms  699 ms  195.44.56.69
 8    *      *      699 ms  194.6.80.253
 9   685 ms  *      685 ms  linx-17-gw1.cwci.net [195.44.30.242]
10    *      *      731 ms  gw.linx.ja.net [195.66.224.15]
11    *      *      *      Request timed out.
12    *      *      *      Request timed out.
13   669 ms  769 ms  725 ms  193.63.201.222
14    *      701 ms  *      194.66.232.129
15    *      *      *      Request timed out.
16    *      *      *      Request timed out.
17   766 ms  *      746 ms  voyager.bl.uk [194.66.233.20]

Trace complete
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Figure 1 notes: Step 1 = Home Hybrary
Steps 2 – 16 = All the links in this chain
Step 17 = The British Hybrary
Asterisks (*) = Broken links/missing packets

The hybrarian gently, but expertly, quizzes the ponytail.

It appears that everything is OK until the packets reach the PQ01Z router as it leaves the #pt#s RNO on it's way to interfacing with the R2D2 polarising anonymiser, where it seems that they just ... mysteriously disappear.

The hybrarian asks if there is anything he can do. The techie rolls her eyes, and spits out the suggestion to 'ring comms'. The hybrarian 'rings comms'. After quizzing comms for a while, the question that has been burning him up finally surfaces: "Is there anything we can do?"

The answer reduces to 'No'.

The only solution is to wait a while. How long? Dunno. Hours ... days ...weeks?

It'll probably just fix itself. Leaving the hybrarian and consumer 'muttering at their machines'.

With a heavy heart the hybrarian rings back the consumer.

They're not happy :

"So what are you going to do about it, then? I was told all you had to do was click on this journal link on the Hybrary's homepage and you could get an article delivered in a couple of hours. Why am I wasting all this time waiting for something that may or may not be there anyway? What are you going to *DO* about it?"

Sound far-fetched? No. This happened in a Hybrary not too far away very recently, and it's not an isolated occurrence. A vital Hybrary service was held up and there appeared to be nothing that could be done about it. Indeed, it *was* about a week before the problem cleared. The problem was not Australia-wide - the agents for Inside in Melbourne had no such trouble.

Case study 1 illustrates that much of what we base our core information access service on, rests on shaky links. Most of our services depend on the web for delivery, and the basic networks that make up the web are NOT as reliable or robust as we might like to think. To quote a recent email from the campus communications unit: "I have attached today's mail from #pt#s ... [the problems] vary from day-to-day, but there is always some problem...".¹

Case study 2: maintaining standards

As some of the readers of this paper will be well aware one of the greatest challenges in the hybrary is maintenance of electronic service delivery standards.

A harassed hybrarian with cordless phone in hand approached us one day..."I've got someone on the line having problems accessing Product X. I've checked the machine at the information desk and everything seems OK. Help!.."

We talk to the suffering user, who turns out to be from the University's Facilities Unit working on an urgent project for Chancellery.

We dig out the ever expanding check list/catalogue of system requirements, pedantic software switches and planetary conjunctions that need to be in place before web

access is possible. We commence the soul destroying task of voyaging through The List with the bemused user (why shouldn't they suffer too?):

- Mac or PC (forget the rest, and Macs too if possible)
- what operating system (eg 16bit or 32bit based)
- has user connected successfully and retrieved Product X files previously
- did user download and successfully install the security plugin & separate password file from the server (representing a unique local authenticating access to web delivered electronic datasets)
- has user successfully downloaded the reader (Acrobat) required to view the Product X files
- is user using the correct *version* of Acrobat reader (nb: at least now Product X can be accessed by both versions of the reader)
- has user more than one version of the reader (the security plugin gets confused if there is!!)
- did user successfully login and search the database
- did user have problems viewing the appropriate Product X file wanted
- did user receive any error messages and what were these

In this case it was the last but one on The List that appeared to be the problem. The user clicks to view Product X file and nothing much appears to happen – just a blank screen.

What to do? Ring Product X support, by now we are on first name terms. We outline the problem.

They say they will ring back.

We explain the situation to the user and recommend they come to the Hybrary as we have not yet abandoned the print archive. They say they haven't got the time. Help.

Product X support ring back and are at a loss to explain why there is a problem. We talk. They have a log of system accesses of the last few days. Hang on a minute...there appears to be a pattern that doesn't make a lot of sense to us. The logs consistently show that most users are logged on for just over 20 minutes. From experience this is not nearly long enough to download larger Product X-Files (most popular ones are large) – especially via a modem. We have a eureka episode: Is there a time out on the system?

The techie chimes in: “..er yeh, 20minutes”

We add another checkpoint to The List.

Case study 2 contrasts with Case study 1 by showing that it is not just telecommunications missing links that break the chain. There are many combinations of other forms of links that can potentially break the chain, in this case over elaborate software requirements and the ever present possibility of human communications error. That the system works at all is due to the efforts of the service personnel at the end of the chain (hybrarians) bullying, cajoling, begging and generally dragging

Product X producers and their products into the realities of mass market electronic information service provision.

We ring the user back with the 'good' news (at least we know what the problem is).....but hang on a tick.....

Case study 3: high latency

STOP PRESS: message from OPTUS...

>>Network Applications Centre engineers report that an increase of traffic
>>from UUNet over the last 30 mins is causing high latency on the
>>RR2 - LA1 cable link. Most customers will be affected by this.
>>At last check the average RTT was 1500ms.²

Oh, that explains it then. We can all go home. Alternatively, the hybrarian may at this point, consider a moment of meditation and contemplation - a prayer to Saint Isidore.³

Analogue: strategies for coping

The final point but one in the information chain in our context is the hybrary. The consumer (and often senior hybrary decision makers) expect the world. After all, the hype and hyperbole about what the internet can deliver knows no bounds.

A growing task of the hybrarian is to try to adjust the perceptions of consumers about the realities of the situation, and to ensure they are aware of all the strategies that can help diagnose, and even solve problems caused by the breaks in the information chain. This chain is immeasurably more complex and tenuous than the print days of yore.

Hybraries have to educate all players to take responsibility for diagnosing and fixing the broken links in the chain. These players include authors, editors, publishers, vendors' system providers, third party aggregators, telecom providers, local organisations' infrastructure providers as well as the poor old hybrarians left holding the end of the (oft broken) chain.

Hybrarians must also see their role as educating and informing consumers about the complexities involved in the delivery of electronic information. Hybrarians must develop a collaborative partnership with these consumers that will facilitate the processes of diagnosing and (hopefully) fixing the recalcitrant links in the chain. For example, consumers need to be taught to document error messages as they appear on the screen and forward these through appropriate feedback mechanisms, as they are often in locations or times where there is no immediate human service help.

Hybraries themselves have to provide the appropriate feedback mechanisms in both synchronous (person/telephone) or asynchronous (email/web forms) modes for all

their user groups to pass on their grievances in (hopefully) a documented way. As part of the collaborative partnership, they have to provide adequate equipment, infrastructure and efficient and seamless authentication procedures to allow transparent access to information resources of choice.

The intermediary telecommunications channels such as ISPs and telecommunications carriers have to improve their service interface, and take responsibility for failures in their domain, and even beyond.

Third party information deliverers such as dataset hosting sites have to develop a good customer service interface with the intermediaries either side of them in the chain, so as to minimise delays caused by transmission problems in the information chain.

Information vendors (aggregators/publishers/database producers) have to be encouraged/educated/dragged kicking and screaming to the service table, and deliver 24 x 7 information delivery to as near 100% level as possible from their end. After all, that is the hype they promote.

Hybrarians must take a pro-active (sorry) role in promoting the need for, and developing in collaboration with other information industry links, SEAMs (Standardised Error Awareness Mechanisms) that will aid the diagnostic and repair process. Seamless information provision and delivery cannot be SEAM-less! Anything less would be unseemly.

It is only when all links in the chain are operating at their optimum, that web-based information delivery reaches a level that consumers now expect as the norm. We would argue that this expectation is a little unreal, and that hybraries need to be more explicit about the service levels that the consumers can expect in today's networked 'nirvana'.

Each point along the chain needs to provide information about service levels that can be expected from their particular link. This way consumers will have the facts that will empower (sorry) them to make the appropriate choices. Table 1. shows that there is not necessarily a direct relationship between time and reliability. For example, a service may be slow and reliable (paper?) or fast and unreliable (electronic?), or any combinations of these variables.

The electronic environment is good at providing quantitative data that can be used to determine measures for indicators such as the ones listed in Table 1. For example, we have explored output measures of database usage in previous VALA papers^{4,5} that can be used to provide consumer information about, for instance, whether they will be able to access the database of choice (where access is limited by simultaneous user limits).

The role of the final intermediary, the hybrarian, is to integrate this data into a realistically-based probability indicator that receives prominence in the service level agreement that the hybrary makes with the consumer.

The hybrarian opening up the service point adds another line to the INDEX (INformation DELivery eXpectation) index for the day..."The probability of successfully getting an Inside article when you access the service today is 87.8%"

Epilogue: chaos or anarchy?

Delivery of electronic information has now reached a stage of maturation where we are able to reflect on the processes involved and develop iterative mechanisms for improving service delivery. If we do not, both knowledge consumers and hybrarians are in danger of being trapped forever on the data side of knowledge. Libraries, like most organisations, tend to respond to incremental changes. By doing this are we failing to understand how complex the electronic environment has become? The rate of change is accelerating to the point where it is becoming obvious that the e-world may be virtually spinning out of control as illustrated in the case studies above. Are we moving within a state of distributed anarchy, mirroring the net itself?

Are there more variables in the e-vironment equation than we bargained for? Does the complexity and possibility for failure increase geometrically or exponentially? Does the concept of 'internet as god', a sort of collective cosmic consciousness and confluence of collaboration, cooperation, and confusion eventually lead to chaos, or simply anarchy?

All of this has happened by default. It is unplanned but at the same time we can take some solace in our historical role as 'keystone species' in our varied information ecologies. We can also take some comfort in the praxis of library service. We have always listened closely to our users, to those knowledge consumers who still trust us as the knowledge guides and collaborators in their information seeking activities.

The time has come for hybrarians to take responsibility for developing mechanisms that will communicate to the consumer, and to senior management where required, the level of certainty of information delivery they can expect from hybraries. To achieve this we need to understand in much greater detail the ever-expanding tangle of links between producer and consumer of scholarly information in the electronic age. This will require further research into the nature of the e-links between authors, publishers, telecommunications channels and carriers, software providers, third party suppliers, organisational IT services and library services that determine the reliability of delivery to the end user. Hybrarians must understand the typology of connectivity and the likely patterns and influences on service delivery that may be no longer within our control.

In understanding more about this e-vironment hybrarians will be better positioned to predict, diagnose, and communicate realistically to users about potential success rates for delivery. More importantly, in the hybrid library this understanding will also inform decisions about the format of resources selected and the delivery of relevant information in the most appropriate format, which for some resources will continue to be the paper and ink variety. Without this understanding and the ability to communicate confidently to our users, librarians are in danger of losing the trust that we have built up over many centuries.

The choice is stark: whether our services become randomly chaotic or predictably random.

If we want to continue to play a beneficial role then let us look at what we are up against when we promise to deliver e-services. Let's be realistic about our promises so that when our knowledge consumers *mutter at their machines* we can at least be satisfied that it is *informed muttering* with the full knowledge of what happens once they click on a link to take them to what they want.

If it is to be the weakest link then let us be clear about what we are offering. More importantly, let us work, collaboratively with all players, to understand and strengthen the links so we can continue to provide high quality hybrid services into the future.

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