IFLA TREND REPORT 2017 UPDATE

"Libraries, as community-based institutions, can both shape, and be shaped by external forces. If we take the time to understand them, we can be pioneers in pushing for stronger, fairer, and more participatory societies"

INSIGHTS FROM THE

IFLA TREND REPORT

Forward from IFLA Secretary General Gerald Leitner

No library exists in a vacuum.

The IFLA Trend Report, released in 2013, was designed to help everyone – both inside and outside the library field – take a step back, and reflect on the forces shaping our work and our lives. By connecting globally recognised experts with our community, it fertilised thinking within IFLA and beyond. Last year's update showed how libraries and library associations around the world had made the most of this opportunity.

It is in the nature of trends that they evolve. They help shape the future, but do not remain constant themselves. The same goes for IFLA's Trend Report. The 2016 Update already highlighted some new emerging tendencies, but to remain relevant, was always going to need refreshing.

We are at a time that IFLA as a whole is looking to the future. Our Global Vision discussion is exploring how the whole library sector can work together to ensure we stay both relevant and influential. I am therefore proud to say that IFLA is committed to keeping the Trend Report updated.

This publication marks the first of a new annual series, bringing together contributions from expert speakers at our annual President's Meeting. It depicts the context in which libraries work to deliver education, reliable information, and opportunities for creativity and personal fulfilment. It provides a further serving of the food for thought provided by the original Report and the 2016 edition. And every five years, from 2020, IFLA will take an entirely new look, giving the space to explore completely new trends that may have emerged.

As community-based entities with a mission to help individuals and societies develop, our institutions both shape, and are shaped by, external forces. If we do not take the time to understand these, we risk being caught unawares, missing opportunities, and ultimately failing to fulfil our goals. If we do take this time, assess the implications, and respond effectively – as many are doing already – we can be pioneers, leading efforts to produce stronger, fairer and more participatory societies.

I encourage all readers – inside or outside of the library field – to think, debate and act on the ideas contained in this update. IFLA, as the global library brains trust, will be stronger for it.

IFLA is the global voice of the library and information profession

IFLA puts libraries on the global stage and helps them develop.

We are the global voice and the largest brains trust of the library and information profession, with an active network of more than 1,400 Members – leading institutions and players in the library field – in over 140 countries, and well-established relations with the UN and other international organisations.

Together with our Members we work to set the professional agenda and develop standards in library service provision, to improve access to information and cultural heritage resources, and to place this work at the heart of local, national and global policies.

Contributors to the Original Trend Report:

Olivier Crepin-Leblond, **Chairman Internet Corporation for Assigned Names and Numbers (ICANN) At-large Advisory Committee (ALAC)**

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Louis Zacharilla, **Co-founder, Global Intelligent Community Forum**

***Commenting in a personal capacity**

The IFLA Trend Report 2017 Update was prepared by Karl Schroeder, Nick Ashton-Hart, Ivan Owen, with thanks to to Vassilis Harambidis, Betty Tsakarestou, Donna Scheeder, Glòria Pérez-Salmerón, Christine Mackenzie, Maria Carme Torras i Calvo and Gerald Leitner.

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Cover page quote: Gerald Leitner

WHAT IS THE IFLA TREND REPORT?

The IFLA Trend Report is the result of the dialogue between the library field and outside experts from a range of disciplines.

By crossing experience and perspectives, it is an opportunity to explore and discuss emerging trends in our new information environment. It is not a static report, but a dynamic and evolving set of online resources for library and information professionals, accessible at trends.ifla.org. There's a great depth of data and information already on the online platform for libraries to use, share and build on, including a bibliography and literature review of existing trend reports, expert papers and discussion summaries.

The original IFLA Trend Report identifies five high level trends in the global information environment, spanning access to information, education, privacy, civic engagement and technological transformation. While it sets out existing and likely future trends which characterise the new digital paradigm, it does not try to forecast the future of libraries, only to identify the forces that may shape this future.

That is where you come in. How libraries evolve in response to these forces will have a decisive influence on whether our institutions remain effective or even relevant in the new information landscape. This is perhaps the most urgent question facing the profession today.

GET INVOLVED IN THE REPORT

From the launch of the Trend Report in 2013, IFLA has been engaging its members and the wider library field to promote and build on the Trend Report. It has helped them to deliver their own workshops, discussion groups, seminars and other activities identifying and discussing information trends most relevant in their region.

In April 2017, IFLA initiated the IFLA Global Vision discussion – a venture that engaged thousands of librarians and library friends from all over the world in a conversation about how a united library field can tackle the challenges posed by ever-accelerating globalisation. Numerous meetings and online threads under #iflaGlobalVision have already been led by librarians from all over the world.

We encourage you to continue the Global Vision discussion and use both the IFLA Trend Report and the IFLA Global Vision Workshop Toolkit to organise and facilitate creative educational workshops with your community, network, colleagues or staff. The toolkit is available at www.ifla.org/globalvision. Stay tuned to news from IFLA at www.ifla.org and follow us on Facebook and Twitter!

1 EXECUTIVE SUMMARY

In 2013, the IFLA Trend Report identified five high level trends which are in the process of transforming our global information environment. These evolving developments spanned access to information, education, privacy, new forms of digital engagement and technological transformation.

Deliberately conceived to embody more than a stationary snapshot of detected trends, the IFLA Trend Report was designed to serve as a catalyst for wider discussion, analysis and action across the international library community.

In 2016, IFLA published the first Trend Report Update to analyse and share the results of three years of intensive debate and discussion across the international library community. These wide-ranging conversations were triggered by the launch of the original IFLA Trend Report in August 2013 at the World Library & Information Congress in Singapore.

This update report has been commissioned by IFLA to deepen insights and provide examples of the impact of globalisation as well as technological and societal trends on the library field. The papers are based on the presentations of four speakers who gave inspiring addresses during the IFLA President's Meeting that took place in Athens in April 2017.

The meeting was focused on the idea of a strong and united library field providing a joint response to the challenges from ever-increasing globalisation. The meeting also kicked off IFLA's next major initiative, the Global Vision discussion.

This has already engaged librarians and library friends from more than 213 countries in the development of a global vision for the future of libraries to ensure that all people have the opportunity to be part of a literate, informed and participatory society.

A summary of key themes covered in the Trend Report 2017 Update can be found below:

Library and Antilibrary: Preserving Truth in the 21st Century by Karl Schroeder, Futurist, NarrativeFutures.com, Canada

• Traditionally, knowledge was subject to 'inertia', due to the cost of its production, and the fact that once produced, the nature of its supports, and the work of institutions such as libraries made it durable.

- While technology has made it far easier to access information, it has also favoured the creation, publication and spreading of misinformation. We risk seeing the emergence of 'antilibraries' – huge, apparently authoritative virtual banks of information that can disappear or be changed even more quickly than they emerge.

- This makes the case for the library – both as a socially valued institution, and as physical infrastructure holding physical collections – being as important as ever. Combined with technologies such as blockchain, which promise to ensure that the authenticity of digital materials can also be guaranteed, as well as a commitment to the investigation, exploration and verification of what is really taking place in the world around us, there is hope for the truth in the 21st century.

Karl Schroeder is a futurist and award-winning author. His ten published novels have been translated into more than a dozen languages. With a Master's degree in Strategic Foresight and fifteen years of consulting experience, Karl has developed a unique approach to futures studies that combines storytelling with rigorous research. His clients include government and corporate organizations that are seeking new templates for transformative change. Born and raised in Canada, Karl now lives in Toronto with his wife and daughter.

Libraries: The Need Has Never Been Greater by Nick Ashton-Hart, Consultant/Adviser at the UN Conference on Trade and Development

- Too many young people still lack a basic education, while automation means the need for life-long learning for adults is acute. Right now, the international community is not meeting the need for either.

- Faced with this challenge, we need new ways of bringing information and training to people, through both technology and local presence. Libraries are indispensable to making this happen.

- Libraries are unique: they're the most trusted information source, have access to the sum total of human experience, yet deliver that global knowledge with a local voice and presence. They must be at the heart of reimagining education for everyone.

- To do this, ubiquitous Internet connectivity is essential for both libraries and citizens. Bringing the rest of the world's population online will pay dividends for all. Public access in libraries offers a great way to do this, especially in developing countries and rural areas where broadband costs remain high.

Nick Ashton-Hart has represented individual artists from punk legends the UK Subs to the Godfather of Soul, James Brown; in multilateral affairs he represented all artists and their managers as head of the International Music Managers Forum. He spent eight years as the Geneva representative of the global technology sector to the UN and now helps UN member-states leverage the digital environment for economic development. He volunteers helping refugees for the International Organisation for Migration – and in Amsterdam helping alcoholics and drug addicts get or stay clean and sober.

3D Printing and Makerspaces in Libraries, by Ivan Owen, Makerspace Lab Manager at the University of Washington, USA

- 3D Printing not only promises to change manufacturing, but also offers new opportunities to individuals to become active makers, rather than passive consumers.

- More and more libraries are opening maker-spaces, where users are able to use 3D printing to create their own things, including life-changing devices such as prosthetics.

- Yet the laws around 3D printed objects remain clear, from design rights to authorisation for marketing.

- 3D printing offers a major opportunity for libraries to take on a new role in their communities, helping users not just be readers, but also to be producers.

Ivan Owen is an interdisciplinary artist and makerspace operator from Washington State, USA. He is the co-creator of the world's first open-source 3D printable prosthetic hand and one of the founding members of the e-NABLE open-source assistive device community. Presently he is employed by the University of Washington, Bothell where he oversees the operations of the campus's Makerspace including educating students in the use of digital fabrication and mentoring teams of student researchers in a broad range of projects. In addition to his university work, he maintains an art practice where he explores the intersections between art, engineering & imagination.

2 LIBRARY AND ANTILIBRARY: PRESERVING TRUTH IN THE 21ST CENTURY

by Karl Schroeder
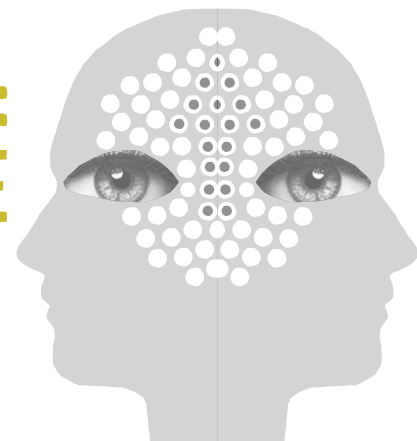
KEY POINTS:

- Traditionally, knowledge was subject to 'inertia', due to the cost of its production, and the fact that once produced, the nature of its supports, and the work of institutions such as libraries made it durable.

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HIGH-SPEED, AUTOMATED LYING

Is "fake news" really a problem? After all, we who curate and use libraries know that the facts of any matter are just a catalogue search away.

Until the 2016 American election, we could laugh off the influence of obviously false information on society. More than that—we could enthusiastically create our own fakes for fun. There are ample websites to assist in this: addletters.com, breakyourownnews.com, http://newspaper. jaguarpaw.co.uk/ and numerous other generators will cheerfully produce a nonsense article or entire newspaper for you with just a few clicks of the mouse.

It's all in good fun—or at least it was, before computer-generated disinformation started to influence politics. Still, politics is a kind of fallen world anyway where, facts are concerned; surely the worlds of academia and science remain immune to machine-generated nonsense?

Unfortunately, not. Even a decade ago, computers were sophisticated enough that some MIT computer science students could code the SCIgen project in their spare time. SCIgen[1] is a fake computer-science paper generator. Its algorithms were already good enough in 2005 that one of its papers, Rooter: A Methodology for the Typical Unification of Access Points and Redundancy[2], was accepted for conference publication.

> ## SURELY THE WORLDS OF ACADEMIA AND SCIENCE REMAIN IMMUNE TO MACHINE-GENERATED NONSENSE? UNFORTUNATELY, NOT

Twelve years ago, SCIgen was a novelty. Today, computers are so fast, and natural-language and data-mining algorithms so sophisticated, that systems of obfuscation and fabrication vastly more powerful exist. They will only get better.

We assume a certain stability to the world of knowledge that we dip into both for recreation and survival. It is important that the instructions in an operating manual for a nuclear reactor be "true," for instance, and in such a case the authenticity of the voice, hegemonic agenda of the text, and assumed gender of the recipient are entirely secondary. We need facts, and even the most philosophically postmodern among us assume that, when it comes to finding a public washroom or looking up the birth date of Louis XIV, we can get them.

> ## WE NEED FACTS

That this easy access to facts seems suddenly threatened makes visible the assumptions we've made all along, the way an ebbing tide reveals the underlying structure of a shoreline. Facts have been

reliable for us not because of any shared philosophical outlook, or because of some iron metaphysical rule that Truth always prevails over Falsity. Actually, facts are reliable because the media we use to store and transmit them possess a quality of literal, physical inertia.

KNOWLEDGE AS INERTIA

Prior to the 21st century, there were material and financial costs associated with the production, dissemination and preservation of information. If it cost money to run a newspaper or print scientific papers, it also cost money to produce gibberish, propaganda and misinformation. Not everybody could afford to do it, and few people had any incentive. Publication costs put selective pressure on what could be printed and preserved, winnowing out the trash in an almost Darwinian manner. The process was far from perfect, and much that is completely wrong-headed has been held as true over the ages. But the cost was always there, so the pressure was too. The general drift of publication has always been towards the preservation of the useful, and what's useful is usually true.

> **THE GENERAL DRIFT OF PUBLICATION HAS ALWAYS BEEN TOWARDS THE PRESERVATION OF THE USEFUL, AND WHAT'S USEFUL IS USUALLY TRUE**

If knowledge had a kind of inertia in that it was hard to get moving, it also had another kind of inertia: once out in the world, it was hard to get rid of. Printed books can last for thousands of years. The combination of print, cultural values and oral traditions has meant that we know stories that were originally told before writing was even invented.

If there is such a thing as a battery for storing informational inertia throughout the era of literacy, it would be the library. The library is not just an idea; the actual building and its actual contents, as physical objects, have played a vital role in the preserving both knowledge and our trust in knowledge. We may say that we trust the library for any number of noble-sounding and even mystical reasons. The real reason the library can be trusted, however, is that it is massive. It has inertia. It is a literal vault for centuries of handcrafted reasoning, argument, and experimentation.

Now, at the dawn of the 21st century, the cost for producing, communicating, and storing information is suddenly approaching zero. In less than a generation, we have gone from a situation where knowledge could be trusted because of its real-world inertia, to one where garbage with the same apparent authority as knowledge is trivial to produce. SCIgen was just the beginning.

THE ANTILIBRARY

Imagine an antilibrary. It contains nothing but falsehoods, blind alleys and discouragement; its purpose is not to educate, but to mislead. The antilibrary comprises millions of texts, articles and essays, all apparently written by authoritative historical figures. There are biographies of these authors—all fabricated—and histories of their squabbles and duels and the various schools of thought that have grown up around them. The library contains many scientific treatises that cite one another in exhaustive detail; it holds records of experiments on the qualities of Aethyr, books on political scandals that never happened, and maps of continents that don't exist. All of these obfuscations are mixed up with references to real people and true historical events, but seamlessly. The antilibrary is a maze without exits.

> **THE ANTILIBRARY IS A MAZE WITHOUT EXITS**

It's not a question of whether the antilibrary will exist. The ability to create it is a necessary side effect of our efforts to build artificial intelligence. For instance, in May 2017, Hewlett Packard Enterprise introduced their new computing architecture, which they call 'The Machine.' The Machine can scale to such sizes that just one could keep every digital health record of every person on Earth in working memory. Altering all of them would be just as easy as storing them.

It's early days for The Machine. Once we develop computers that speak, write coherently, combine ideas and make references to facts, then these systems can, just as easily, speak, write, and refer to complete nonsense. When entire libraries can be held in memory, and facts, citations and references can be altered at will throughout every work stored in them, we have the beginning of the antilibrary.

> **WHEN ENTIRE LIBRARIES CAN BE HELD IN MEMORY, AND FACTS, CITATIONS AND REFERENCES CAN BE ALTERED AT WILL THROUGHOUT EVERY WORK STORED IN THEM, WE HAVE THE BEGINNING OF THE ANTILIBRARY**

Why stop at one antilibrary? As computers become faster, they'll be able to write fake books and encyclopedias more and more efficiently—initially as some slow rate such as ten Wikipedias per hour, then a hundred per hour, then a thousand.

Soon antilibrary systems will be able to spawn entire internets, at a rate thousands of times faster than humanity could read them.
This will happen because information technology works just as efficiently on garbage as it does on

facts. It will happen because there are many disaffected groups around the world who simply don't believe in this or that element of the grand narrative we store in our libraries. When computing power becomes cheap enough, kids will make antilibraries for fun. Students will generate them to create false references for essays they will have claim to written that will, themselves have been authored by an antilibrary.

> ❝❝ *INFORMATION TECHNOLOGY WORKS JUST AS EFFICIENTLY ON GARBAGE AS IT DOES ON FACTS*

All of this is possible now because knowledge has lost its physical inertia. It has become dematerialized—and libraries themselves are directly complicit in making this happen. After all, dematerialization is simply the scanning, uploading into, and storage of information in digital media. It's the prevalent trend today. Dematerialization is cheap and efficient, and supposedly it also guarantees greater permanence to our knowledge, which is otherwise consigned to fragile, flammable, and heavy paper. But digital information has no necessary relationship to knowledge, as we're now discovering. All of that scanned and stored data is as vulnerable as it's possible for it to be; it can all be changed, deleted or replaced in an instant. Sooner or later, it will be. Can anything stop the inevitable overwriting of everything we know?

REASSERTING THE VALUE OF INERTIA

Luckily, if dematerialization is the problem, it is also the antilibrary's Achilles' Heel. The antilibrary works only because the cost of producing digital information is so trivially low. Turn this idea around, and what's clear is that the library works precisely because the cost of producing and storing knowledge is high.

In other words, the physical inertia of the library is as precious as the information stored in it. Therefore, in order to preserve the information that comprises our knowledge, we need to also preserve its inertia. "Information wants to be free," according to Stewart Brand. He also said, "Information also wants to be expensive," and although he meant that in a slightly different way, we can adapt the idea here. Information may be free, but knowledge is valuable, and by embodying that value in physical things—things that have inertia (and thus cost)—we can defend our knowledge against the antilibrary.

> ❝❝ *THE PHYSICAL INERTIA OF THE LIBRARY IS AS PRECIOUS AS THE INFORMATION STORED IN IT*

There are at least three kinds of inertia that information needs to have, in order to be preserved as knowledge: social inertia, physical inertia and, in our age, digital inertia.

Social inertia means that knowledge is preserved by us—by human actors who share values and goals. In the absence of any books or buildings, the library is a tradition and a cultural norm. We have to preserve the institution of the library, and the profession of the librarian, even in an era when they seem to be redundant. We can surely crowdsource an encyclopedia, even a global library. It's fast and efficient. It's also vulnerable to exactly the same technologies that enable it.

Physical inertia means that the library as an actual, real-world place—and the book as an actual physical object—continue to have value. Books and buildings have longer lifespans than humans; thus, the Renaissance was able to rediscover much classical literature because the physical texts had survived, even when the people, cultures, buildings and traditions had not. Also, books are expensive, and cost (as neocon economists insist) signals what we value.

> ❝❝ *THE LIBRARY AS AN ACTUAL, REAL-WORLD PLACE—AND THE BOOK AS AN ACTUAL PHYSICAL OBJECT—CONTINUE TO HAVE VALUE*

It might seem strange to suggest that there could be digital inertia, too. Digital media are famously ephemeral. Though we do have the Wayback Machine, which partially archives the Internet, the Wayback Machine could be unplugged as easily as any server. Digital objects just don't possess the qualities of persistence, localization, and uniqueness that physical objects have.

At least, they didn't until very recently. The blockchain technology that lies behind Bitcoin has introduced a new factor to computing—a kind of digital version of physicality, where something like a Bitcoin can be said to exist, be unique, be unforgeable, and have only one owner. Although it's an entirely digital entity, a Bitcoin cannot be copied. Entities like Bitcoins that live in a blockchain also possess an unalterable history, giving them the kind of provenance that only physical objects previously had. Blockchain technology provides a possible online antidote to the antilibrary. It isn't necessary for us to turn our backs on the efficiencies of dematerialization and on the vast potential for education and global benefit that accrue from Internet technologies. We may be able to assign the knowledge we trust to a 'blockchain of truth' where accepted and verifiable facts reside in plain sight, in an unalterable and unforgeable manner.

For the moment, this last form of inertia is pure speculation. Regardless of whether blockchains turn out to be capable of mimicking physical media's ability to preserve knowledge, the fact is that the institution of the library, the place itself, and the librarian and the book are still needed and will become even more valuable as antilibraries come into being. There is a long life ahead for the people, places and things that preserve knowledge.

THE KNOWN VS KNOWLEDGE

We could leave things there; but what about Knowledge, as opposed to knowledge? How will we ever know that what we are preserving is not itself a vast, ancient, and persuasive antilibrary? One might, on entering a real library, have a momentary feeling of doubt. Perhaps none of this is real? Maybe we have spent our whole lives guarding an empty vault?
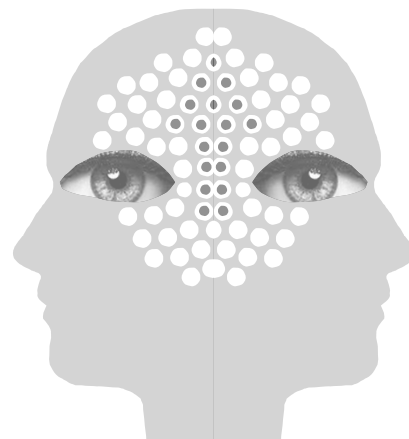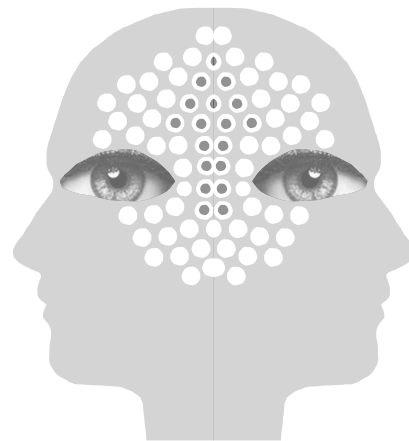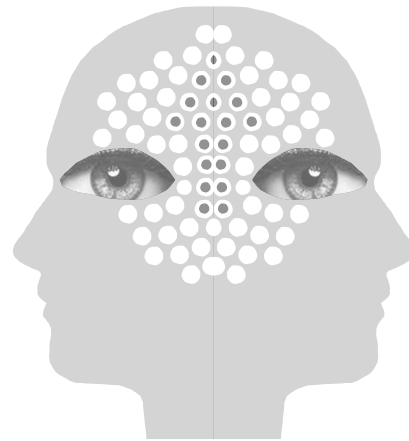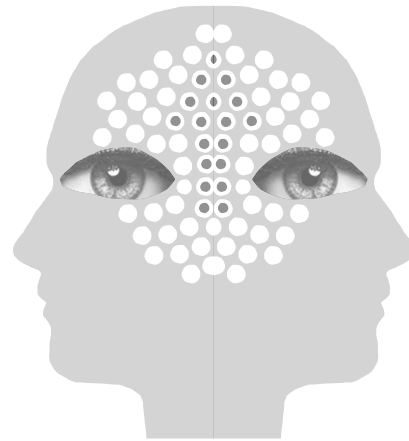
Kurt Vonnegut once observed that "Reality is that which, when you stop believing in it, doesn't go away." Maybe, then, we can add a fourth kind of inertia to the other three that will preserve our faith in what we're guarding. This fourth kind of inertia is just what's really out there in the world. The Acropolis really does still stand in Athens; Paris is in France; and Archaeopteryx really exists, preserved in its stone. Even if it were overwritten a million times, most of what we know could still be recovered because it was originally authored by, and written on, the world itself. The real library is a record of the goings-on in that world, and through investigation, exploration and the constant re-verification of facts, we can find it again if we have to. And if we are willing.

AUTHOR'S BIO

Karl Schroeder is a futurist and award-winning author. His ten published novels have been translated into more than a dozen languages. With a Master's degree in Strategic Foresight and fifteen years of consulting experience, Karl has developed a unique approach to futures studies that combines storytelling with rigorous research. His clients include government and corporate organizations that are seeking new templates for transformative change. Born and raised in Canada, Karl now lives in Toronto with his wife and daughter.

1 https://pdos.csail.mit.edu/archive/scigen/
2 https://pdos.csail.mit.edu/archive/scigen/rooter.pdf

3 LIBRARIES: THE NEED HAS NEVER BEEN GREATER

by Nick Ashton-Hart

KEY POINTS:

- Too many young people still lack a basic education, while automation means the need for life-long learning for adults is acute. Right now, the international community is not meeting the need for either.

- Faced with this challenge, we need new ways of bringing information and training to people, through both technology and local presence. Libraries are indispensable to making this happen.

- Libraries are unique: they're the most trusted information source, have access to the sum total of human experience, yet deliver that global knowledge with a local voice and presence. They must be at the heart of reimagining education for everyone.

- To do this, ubiquitous Internet connectivity is essential for both libraries and citizens. Bringing the rest of the world's population online will pay dividends for all. Public access in libraries offers a great way to do this, especially in developing countries and rural areas where broadband costs remain high.

INTRODUCTION

Digitization has transformed human society and our economies and raised questions about one of our most durable institutions, libraries and archives. While public questions have been raised as to whether libraries would be made redundant by technology as (for example) search engines made the acquisition of information easier, it turns out that instead, technological transformation is making them more and more central to healthy societies.

THE INTERNATIONAL COMMUNITY IS BADLY FAILING ALL AGES IN PRIMARY, SECONDARY, AND ADULT EDUCATION.

At the rate of current progress, UNESCO estimates the world will achieve universal primary education in 2042, and universal secondary education in 2084[3].

The Sustainable Development Goals (SDGs) adopted by the world's heads of state at the United Nations in 2015 would have us meet those objectives by 2030[4].

> *EVEN IN THE MOST ADVANCED ECONOMIES THOSE WORKING TODAY WILL NEED LIFE-LONG TRAINING AND EDUCATIONAL OPPORTUNITIES*

By that same date automation and artificial intelligence will transform employment and production, eliminating between 9 and 47% of all jobs - with as much percentage variation in what new jobs these technologies may or may not create.[5] What is certain is that even in the most advanced economies those working today will need life-long training and educational opportunities that our societies simply don't provide now, as they migrate between the jobs of today and those that will replace them.

WE HAVE TO REIMAGINE EDUCATION TO MAKE OUR EDUCATIONAL NEEDS MEET DEMAND.

For the adults of tomorrow, to reach just the primary and secondary education targets the SDGs call for will require 69 million more teachers worldwide according to UNESCO estimates. We only have about 30 million in total now.[6]

> *THE SOCIAL AND ECONOMIC FABRIC OF DEVELOPED COUNTRIES CANNOT MANAGE DISPLACEMENT OF UP TO HALF THE WORKFORCE WITH OUR CURRENT PARADIGM OF ADULT CONTINUING EDUCATION*

The social and economic fabric of developed countries cannot manage displacement of up to half the workforce with our current paradigm of adult continuing education. Nor can it handle a large share of humanity permanently trapped in poverty because low-skilled jobs in, for example, Bangladeshi garment factories are all displaced by robots.

People simply won't stand for it, and the political class worldwide would be swept aside if they fail to provide results.

LIBRARIES ARE THE GLOBALLY AND LOCALLY TRUSTED SOURCE OF INFORMATION

The enormity of these two challenges require us reinvent our approach to education for everyone, not simply to make adjustments to our present educational paradigms. Our libraries must be an indispensable, integral part of both the process of reinvention and the delivery of the results. Here's why.

We've never had access to more raw information, but the tools we have to verify accuracy and create context are far less evolved. Search engines can prioritize relevance but cannot create trust or provide the context necessary to take disparate results and relate them on the basis of trust into a narrative. The human mind may doubt other humans, but we doubt automated intermediaries even more. We are also designed to trust local interlocutors more than those who are distant from us because we relate to them: you can present the same fact the same way and different cultures will perceive it differently. We know this and it influences whom we trust.

> *WE'VE NEVER HAD ACCESS TO MORE RAW INFORMATION, BUT THE TOOLS WE HAVE TO VERIFY ACCURACY AND CREATE CONTEXT ARE FAR LESS EVOLVED*

That's where our libraries are indispensable: collectively they contain the sum of all human knowledge, yet individually they are physically present in millions of cities, towns and villages. Their librarians are locals who share the social and cultural context of those they serve. They bring that vast collection into a local context that gives facts meaning in each socioeconomic reality, a context and meaning algorithms can as yet only dream of and which locals will inherently see as far more trustworthy.

> *LIBRARIES BRING THAT VAST COLLECTION INTO A LOCAL CONTEXT THAT GIVES FACTS A CONTEXT AND MEANING ALGORITHMS CAN AS YET ONLY DREAM OF AND WHICH LOCALS WILL INHERENTLY SEE AS FAR MORE TRUSTWORTHY*

Widespread application of distance learning and completely new approaches leveraging technology are not optional. We need great teachers to be able to teach thousands of students at once, not 25. While some universities are experimenting with this[7] now it will have to become the norm, along with tools that allow all of us to retrain ourselves, and which can operate at a similar scale.

Everything we know about education has shown that educational quality increases as class sizes shrink.

Somehow, we have to leverage technology to flip that on its head. If we can send living humans to the moon and bring them home safely we can find a way to meet this challenge - if we allocate sufficient resources and incentivize our innovators and educators to collaborate, we can do it.

Libraries cannot replace schools and teachers - but if we're smart we can make them central to achieving the primary and secondary educational goals the SDGs call upon us to meet. That means making them a core part of the decision-making that affects them and the entire educational process, not at the end as a consumer of policy, but as an originator and partner in developing policy.

We need to make them central to the retraining of adults and life-long learning that technological change will demand of all of us. We need their advice on how the innovations in education that technology can provide can act as a 'force multiplier' to increase the value of the knowledge they hold in each town and village. After all, libraries are our most trusted source of information[8] - how could they be otherwise? They are also the only global, interconnected knowledge management and dissemination institution that operates locally and provides that key local context to information. That means they are already the central institution to global knowledge dissemination.

> *LIBRARIES ARE OUR MOST TRUSTED SOURCE OF INFORMATION. THEY ARE ALREADY THE CENTRAL INSTITUTION TO GLOBAL KNOWLEDGE DISSEMINATION*

All that remains is for governments and educational institutions and policymakers to put them at the heart of their own work.

PLUGGING IN:
THE NEED FOR, AND BENEFITS OF, UNIVERSAL CONNECTIVITY

It is axiomatic that to deliver the aggregated information of the world libraries must themselves be interconnected technologically and must themselves have the tools to leverage that gigantic universe of human knowledge to its full. Here again is a massive challenge, and a massive opportunity.
More than 50% of humanity are still unconnected to the Internet - the "digital divide." Those unconnected are disproportionately concentrated in developing countries, with the poorest countries on average being the worst off in terms of access – average connectivity is around 15% of the population. The principle of network effects means that everyone we connect online does not simply add to the value they enjoy from the network by their personal interactions but

improves the value of that network for everyone else, in the same way that increasing the number of people with telephone connections made the telephone more valuable for everyone who already had one. In short, the next 20% of humanity that we connect will almost certainly produce more impact on everyone else than all of us connected now current do. Think about that for a minute.

LIBRARIES CAN BE A BRIDGE TO THE ONLINE WORLD FOR THE HALF OF HUMANITY STILL OFFLINE

We need ubiquitous individual Internet connectivity - but while we work on that problem we need to guarantee that libraries - all of them, every single one - can provide Internet access to those who visit them, so even those who cannot afford their own Internet connection can get online at their local library. Our libraries need that connectivity themselves so they can share their collections, activities and ideas with one another, too.

The need is greatest for developing countries, where the regulatory and legal change that will support the development of and dissemination of local content AND everything from the rest of the world is least developed too, not least in terms of copyright and related rights, amongst other areas.

WE NEED TO GUARANTEE THAT LIBRARIES - ALL OF THEM, EVERY SINGLE ONE - CAN PROVIDE INTERNET ACCESS TO THOSE WHO VISIT THEM, SO EVEN THOSE WHO CANNOT AFFORD THEIR OWN INTERNET CONNECTION CAN GET ONLINE

Again, libraries are the global institution with local presence: if we can connect every one of them, they can provide critical additional free access to the online world, with the training in its use, that the billions of the unconnected need. They offer a realistic, globally available, accessible path to affordable, ubiquitous individual access. No other institution does.

STRONGER, FAIRER SUSTAINABLE GROWTH: NOT WITHOUT LIBRARIES

We need to reinvent education and we can only do that if our libraries are central to the reinvention and its realisation. We need to connect the unconnected – and again, libraries are absolutely critical in connecting the unconnected AND giving them the educational tools they need to transform their own lives. You may be thinking, OK, in many places sure, but do people really GO to libraries in advanced economies, or do they just Google?

LIBRARIES ARE THE GLOBAL INSTITUTION WITH LOCAL PRESENCE

After all, it has been fashionable in some circles to suggest that the Internet is making libraries redundant, that people would not visit them any longer if they can find anything they want online, that libraries are an ancient institution looking for a purpose in the 21st century[9] . That idea, it turns out, is not just wrong, but 100% wrong. Pew Research recently released a study[10] that reveals that in the USA, one of the world's most connected, guess what generation not just uses, but visits, libraries more than any other? Millennials. The first generation of digital natives. And not on apps - libraries have them too - but in person. Pew's results are not the only study that bears this out, and they won't be the last.

GUESS WHAT GENERATION NOT JUST USES, BUT VISITS, LIBRARIES MORE THAN ANY OTHER? MILLENNIALS. THE FIRST GENERATION OF DIGITAL NATIVES

Our libraries have always been at the heart of healthy and successful societies. They matter. With every massive technological shift, doomsayers have predicted their demise and have been wrong, just as they are now. In a globalised world we have never needed them more than we do today, but they need our support too.

IN A GLOBALISED WORLD WE HAVE NEVER NEEDED LIBRARIES MORE THAN WE DO TODAY, BUT THEY NEED OUR SUPPORT TOO

After all, as one of ancient Rome's most famous and educated citizens, Marcus Tullius Cicero, once said:

"If you have a garden and a library, you have everything you need"

AUTHOR'S BIO

Nick Ashton-Hart has represented individual artists from punk legends the UK Subs to the Godfather of Soul, James Brown; in multilateral affairs he represented all artists and their managers as head of the International Music Managers Forum. He spent eight years as the Geneva representative of the global technology sector to the UN and now helps UN member-states leverage the digital environment for economic development. He volunteers helping refugees for the International Organisation for Migration – and in Amsterdam helping alcoholics and drug addicts get or stay clean and sober.

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4 3D PRINTING AND MAKERSPACES IN LIBRARIES

by Ivan Owen

KEY POINTS:

- 3D Printing not only promises to change manufacturing, but also offers new opportunities to individuals to become active makers, rather than passive consumers.

- More and more libraries are opening maker-spaces, where users are able to use 3D printing to create their own things, including life-changing devices such as prosthetics.

- Yet the laws around 3D printed objects remain clear, from design rights to authorisation for marketing.

- 3D printing offers a major opportunity for libraries to take on a new role in their communities, helping users not just be readers, but also to be producers

INTRODUCTION

3D printing is a catch-all term which refers to the broad field of additive manufacturing. A subtractive manufacturing process involves starting with a given material and then removing portions of that material until something is produced (e.g. wood-working, machining, etc.). Additive manufacturing involves progressively adding layers of material until something is produced. A wide range of machines exist which are capable of 3D printing objects out of materials including ceramic, metal, plastic, paper, and even living cells. This is already impacting a variety of industries which produce solutions for daily life. High precision metal and plastic 3D printers are used in the dental & medical industry to create implants, braces and surgical guides.

Many common consumer products, like video game controllers or phone cases, are prototyped via 3D printing prior to going into full production. Groups of private citizens around the world are leveraging this technology to collaboratively create and release a wide range of devices for home use. As more com-panies and individuals experiment with the technology, its use for these purposes and more will likely become far more commonplace.

> *AS MORE COMPANIES AND INDIVIDUALS EXPERIMENT WITH THE TECHNOLOGY, ITS USE FOR THESE PURPOSES AND MORE WILL LIKELY BECOME FAR MORE COMMONPLACE*

The lowest cost, and therefore most likely types of 3D printers to be encountered, use either a plastic filament which is melted and then extruded, or liquid plastic which solidifies when exposed to ultra violet light. These plastic 3D printers are produced by many companies and models with varying attributes can be purchased for $400 - $4,000 USD. There are also higher precision machines capable of using a wider range of materials in the $5,000 - $20,000 USD range. The availability of these machines is a large factor influencing small companies and individuals making the choice to begin using the technology.

FROM THE FACTORY TO THE LIBRARY: BRINGING 3D PRINTING INTO THE COMMUNITY

The machine costs described above are part of a trend within the industry where 3D printers continue to decrease in cost and increase in quality. Librarians are already exploring this trend, and libraries all over the world are starting to make 3D printers available to their patrons. In addition to simply making these machines available, some libraries are going a step further and developing makerspaces wherein patrons can access a variety of tools and learn the basics of design.

The public availability of 3D printing and makerspaces creates new possibilities for communities, presents a variety of challenges and raises interesting questions to be explored moving forward.

> *THE PUBLIC AVAILABILITY OF 3D PRINTING AND MAKERSPACES CREATES NEW POSSIBILITIES FOR COMMUNITIES*

Apart from access to additive manufacturing in schools and universities, one of the most common places that people can access 3D printers are makerspaces. A makerspace is, generally speaking, a location where people with shared interests in computing, technology, design & craft can meet up to work on solo or collaborative DIY (Do It Yourself) styled projects. These spaces often host a variety of machines & tools depending on the interests of the space users. Items found commonly in makerspaces include computers, 3D printers, basic metal working tools, laser cutters, hand tools, soldering irons and electronics development platforms such as Arduinos. By having communal access to these locations as well as meeting other enthusiasts, space users are able to benefit from technologies and knowledge that might be otherwise difficult for them to personally purchase or find.

Many libraries have now opened or are currently developing their own makerspaces. This appears to be a natural extension of how libraries have historically provided access to computing and audio/visual technologies as well as their role as community centers. The impact and use of such spaces is still being explored as this is a relatively new trend. The first public library to open a makerspace in the United States, for example, was the Fayetteville Free Library in New York State in 2011[11]. Most of these libraries have begun hosting meet-ups and workshops held in their makerspaces which provide STEM/STEAM education to their local communities.

DEVELOPING MAKERS SPACES APPEARS TO BE A NATURAL EXTENSION OF HOW LIBRARIES HAVE HISTORICALLY PROVIDED ACCESS TO COMPUTING AND AUDIO/VISUAL TECHNOLOGIES AS WELL AS THEIR ROLE AS COMMUNITY CENTRES

One of the things which these pioneering library makerspaces are able to benefit from is the availability of free design software which their patrons or the library itself can download and use for non-commercial purposes. Excellent free 3D design packages, for example, include Autodesk Fusion 360, Blender, OpenSCAD, FreeCAD & TinkerCAD. By using one of these software options in conjunction with access to a community makerspace, patrons have an accessible pathway to begin learning and practicing design and additive manufacturing.

Library makerspaces provide powerful opportunities along with new challenges and concerns to navigate. Patrons of these spaces have the ability to create or replicate an incredibly wide range of objects, tools and designs from all over the world. An example project which illustrates both the benefits as well as the challenging questions which can arise in a library makerspace is the e-NABLE project. e-NABLE is a

LIBRARY MAKERSPACES PROVIDE POWERFUL OPPORTUNITIES ALONG WITH NEW CHALLENGES AND CONCERNS TO NAVIGATE

There have now been several news articles documenting how public library makerspaces have been used to fabricate e-NABLE hands. In one instance a boy made a hand for himself using a printer at the Wilmington Public Library in Delaware[12]. Other examples include a teenager in Kansas building a hand for his young friend[13] and young brothers in California who made a hand for an adult[14]. In all of these examples, a prosthetic devices was manufactured and delivered in a non-medical setting by people with no formal training. Additionally, while the hands made by the e-NABLE community are free, the individual designs carry different creative commons licenses for their use.

NEW TECHNIQUES AND OLD LAWS: WHAT CHALLENGES?

Depending on where in the world a library is located, making something like an e-NABLE hand could lead to a library patron being in violation of government regulation or intellectual property law. In the United States, for example, a body-powered upper-limb prosthetic devices is considered low risk by the US FDA and pre-marked upper-limb devices of this type are not regulated. What this means is that, as long as someone gives the arm away for free, they are not in violation of the law. If a US library patron were to make and then sell a prosthetic arm, they would be in violation of FDA regulations. One of the challenges inherent with 3D printing technology is the machines make it easier replicate a copyrighted, trademarked or patented design. As an example, if a sculptor sells small castings of their statue, someone could in theory use a 3D scanner to make a model of it, and then use a 3D printer to create additional copies of the work without the artist's permission. This would be a violation of copyright law, but also very difficult to monitor, track and enforce. Conversely, most of the e-NABLE devices mentioned earlier are available under a Creative Commons, Non Commercial license. Therefore people are free to make and distribute arms carrying a license of this type as long as they do not sell them. The same ease of use that makes it possible to replicate protected work is also the primary mechanism which makes it easy to share work intended for public use.

DEPENDING ON WHERE IN THE WORLD A LIBRARY IS LOCATED, MAKING SOMETHING LIKE AN E-NABLE HAND COULD LEAD TO A LIBRARY PATRON BEING IN VIOLATION OF GOVERNMENT REGULATION OR INTELLECTUAL PROPERTY LAW

These are just two examples of the many items that library patrons could make which might lead to these kinds of questions around law and regulation. It is also one of many examples of the potential highly positive impact these spaces can have, as e-NABLE hands cost only $50 to build and are an alternative to limbs which cost between $2,000-$5,000 to purchase. Health regulations & intellectual property laws are often not common knowledge, so if libraries work to educate their makerspace users on these topics it could help their patrons to navigate these potential issues as well as help them to understand what is or isn't permitted under their local laws and regulations.

FROM READERS TO MAKERS: LIBRARIES DRIVING CREATIVITY

The potential issues aside, an important thing to note about this example is that the library users who have built hands are not just passive recipients of a previously generated design. In the case of the young brothers in California, they have since joined the e-NABLE community and are now experimenting on creating new & better designs for low-cost 3D printable hands. They are able to leverage their library's makerspace as a location where they can engage in this research and development to make contributions to an active global open-source community.
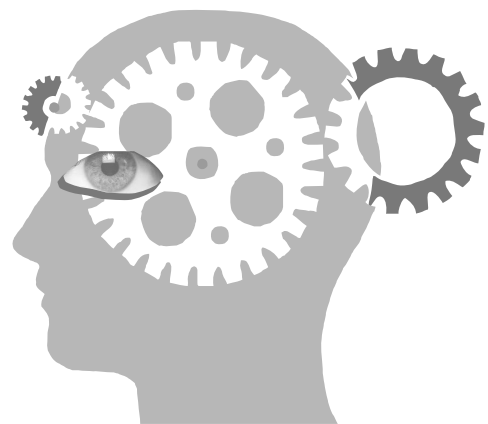
> *USERS ARE ABLE TO LEVERAGE THEIR LIBRARY'S MAKERSPACE AS A LOCATION WHERE THEY CAN ENGAGE IN THIS RESEARCH AND DEVELOPMENT TO MAKE CONTRIBUTIONS TO AN ACTIVE GLOBAL OPEN-SOURCE COMMUNITY*

With the concept of public-library makerspaces being less than a decade old, it is difficult to make predictions about how they will develop and what their presence will mean for patrons. They could serve as a new tool to advance the many ways in which libraries operate as community centers. There is great potential to use this kind of space for hands-on STEAM education. Perhaps most exciting is how the patrons themselves could assist in shaping the way such spaces are structured and what they are for.

AUTHOR'S BIO

Ivan Owen is an interdisciplinary artist and makerspace operator from Washington State, USA. He is the co-creator of the world's first open-source 3D printable prosthetic hand and one of the founding members of the e-NABLE open-source assistive device community. Presently he is employed by the University of Washington, Bothell where he oversees the operations of the campus's Makerspace including educating students in the use of digital fabrication and mentoring teams of student researchers in a broad range of projects. In addition to his university work, he maintains an art practice where he explores the intersections between art, engineering & imagination.

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