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Library Hi Tech News

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Article information:

To cite this document:
Peter Fernandez , (2015),""Through the looking glass: envisioning new library technologies" how inexpensive computers can transform information access and literacy", Library Hi Tech News, Vol. 32 Iss 7 pp. 4 - 7
Permanent link to this document:
http://dx.doi.org/10.1108/LHTN-07-2015-0046

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Introduction Moore's Law

In general, Moore's Law predicts that the core components of computers will continually become smaller, faster and cheaper in a relatively short time. More specifically, Moore's Law describes the historic doubling of "the number of transistors in a dense integrated circuit [. . .] approximately every two years"(Moore's Law, 2015). Over time, Moore's Law developed into an industry-wide goal and even into a marketing gimmick. However, since its inception, Moore's Law has been about more than just computer transistors. Rather, it means the computers to which most people have access will also become significantly more powerful.

This column will explore how one aspect of Moore's Law – price – can have a transformative effect on the utility of computers. As computers become increasingly inexpensive, they become more accessible to new audiences. Individuals, libraries and other institutions are using these new, inexpensive computers to interact with information, and the world, in new ways.

What is inexpensive?

To call something inexpensive is to invoke a relative concept. What is an exorbitant cost to one person might be considered economical to another. The definition of inexpensive can vary not only from person-to-person, but from place-to-place. To take a simplistic example from the world of computers, Bill Gates is currently the world's wealthiest person (Anderson, 2015). According to a calculation done by Neil DeGrasse Tyson in 2011, for it to be worth Bill Gates' time to pick up off the ground the equivalent of 25 cents (or €0.23), he would need to simultaneously also find approximately $45,000 (€40,537.25) (Dunn, 2014).

Of course, human psychology being what it is, Bill Gates claims that he would bend down to pick up significantly less money (Love, 2014). Considering this claim, the true value of any technology can be understood only within the context of its social and economic ecosystem. For instance, cell phones are sold at different prices, with different payment plans in different regions. Perhaps more importantly, the infrastructure associated with cell phone service can also vary dramatically. A cell phone that has ready access to high-speed Internet in a city, and can use an app to tap into local vehicles for hire, has a very different utility than one used in sub-Saharan Africa primarily for texting and photography (Pew Research Center, 2015).

Still, by and large, the less something costs, the more people who will be able to afford it. When computers are designed specifically to be cheaper and are combined with the right features, that factor alone can enable new uses and power innovative change.

The future of microcomputers: C.H.I.P

Emblematic of these new, extremely inexpensive computers is a device called C.H.I.P. that has recently been funded by Kickstarter. These computers, if successful, will retail for a mere $9 (€8.11) and be sold starting in May 2016. At that price, they are almost four times cheaper than the leading existing microcomputer, the newest Raspberry Pi. Both C.H.I.P. and Raspberry Pi are smaller than a credit card, but can connect to a wide variety of interfaces using both wireless and wired connections. C.H.I.P. is also launching with an official accessory, dubbed Pocket C.H.I.P., that will enable users to treat the tiny computer as a small touchscreen and keyboard (Wong, 2015).

The creators of C.H.I.P. claim that it will be able to play video games, run productivity applications, create music and access the Internet, as well as be a functional tool for teaching novices how to code (Next Thing Co, 2015). Yet, it will still be limited in many ways: the proposed computer will have only a 1 GHz processor, 512 MB of RAM and 4 GB of flash storage. Also, for most purposes, additional accessories will be needed to effectively interact with C.H.I.P. Therefore, it is not an out-of-the-box replacement for traditional computers. However, if successful, it will not be the first microcomputer to alter expectations about what can be done by a tiny, custom-built, inexpensive computer.

Raspberry Pi

The Raspberry Pi is perhaps the most illustrative current example of how transformative an inexpensive computer can be. Like C.H.I.P., Raspberry Pi received some of its startup costs and promotional buzz through the crowdfunding platform, Kickstarter. It was designed in part to make programming and other basic computer literacy skills more accessible. Once learned, programming has a nearly limitless number of potential applications. Programming forms the building blocks of modern technology and understanding it can

arguably enable a deeper understanding of the world. It can also be a creativity tool, allowing for personal expression. Programming is at the heart of many new businesses and games. By providing the world with a computer that is affordable, and powerful enough to run programming languages alongside an ever increasing array of accompanying tutorials, Raspberry Pis were intended to help bring this form of literacy to new audiences.

Since they became available to the public in 2011, at an initial price of around $25, users around the world have discovered how transformative access to economical computing can be. Not only can individuals use them, but their existence has created the space for an array of new educational opportunities. Institutions like libraries, schools and many others have designed classes with Raspberry Pi machines in mind. Common examples include classes on programming in Python or creating music using a program called Sonic PI (DeLamielleure-Scott, 2015). This is such an effective teaching technique that the BBC has announced that it will begin giving its own version of a microcomputer, the Micro:bit, to every child in the UK in Year 7 to help empower students critical understanding of how computers work (Paul, 2015b).

For many of these institutions and their users, these courses would not have been feasible without the availability of an extremely affordable computer. Additionally, a whole community of interested hobbyists have built up around the machines, which has in turn led to the development of numerous tutorials and support groups to facilitate self-directed learning.

At such a low price point, the machine has many limitations. Each additional feature adds to its cost, and so its initial specifications were chosen carefully to foster accessibility and flexibility. Raspberry Pi computers run the open-source operating system Linux. Linux is not only free in terms of cost, but it is also free of many of the intellectual property restrictions that other operating systems have, which in turn has allowed it to build a robust community of technologically sophisticated users. This community, and the programs they had already created, helped to form the core of Raspberry Pi's built-in audience and library of programs.

The other key factor in Raspberry Pi's design is that it is expandable and adaptable. In addition to standard connectivity options, such as USB, HDMI and SD cards, Raspberry Pis also include a "general-purpose input/output" (GPiO) circuit. With these connectors, the Raspberry Pi machine can connect to almost any other electronic device. Several devices can also be chained together with the Raspberry Pi to create a more powerful machine or connect to sophisticated sensors and scientific lab equipment. The inclusion of this feature at such a low price point was particularly remarkable at the time and has allowed the Raspberry Pi to be used in ways that its creators likely could not have anticipated.

Users have connected these devices to security cameras and used them to power music players, voice-controlled microwaves, FM radio signals, Internet-enabled mirrors (that display the weather outside) and even a mini data center, to name just a few uses beyond the usual desktop computing possibilities (Nazario and Suleman, 2015; Paul, 2015a).

Library applications

Although limited in some important ways, these extremely small, inexpensive computers can be used by libraries to expand access to educational opportunities, as well as to make libraries more efficient.

Computers such as these can be checked out to patrons and paired with a mobile hotspot, as mentioned in Volume 32, Issue 3. The hotspot allows for access to the Internet, and the Raspberry Pi, with modifications to make it as user friendly as possible, can provide the computing power to run a basic Web browser. The end result is affordable, portable Internet access. While it would have some limitations, this potential application highlights how transformative the price point can be. Because the computer is easily replaceable, accompanying usage policies, which can be a major bureaucratic barrier for more expensive equipment, can be avoided. With the infrastructure in place, libraries can focus on ensuring that patrons have the information skills to access all the resources made available online.

These types of inexpensive microcomputers can also have a transformative effect within libraries. At least one library has used them to host their online public-access catalog. Using a Web browser and the Internet, libraries can afford to set up workstations for patrons in locations that could prove prohibitively expensive under other circumstances (Enis, 2013; Wells, 2014). This same budget-conscious logic applies for other library technology applications. Inexpensive computers can allow libraries to host digital signage, local data centers or check-out machines in locations that would not be practicable at a higher price point.

Libraries can also use these machines to host educational experiences. They have a natural role to play within Makerspaces, Tinkerlabs and other library initiatives that encourage patrons to use technology to craft new things. The robust community that has already developed around this technology means that there are many resources available for librarians, as well as the general public. Numerous examples and how-to articles have been written by libraries that have hosted workshops for patrons of all kinds from master gardeners to future parents (Holing, 2015).

A final caution

Amidst all this enthusiasm within a robust community, it is worth highlighting that Raspberry Pi and other similar devices are still hobbyist technology. These devices are not simply a more inexpensive equivalent of a Windows desktop machine or even a mobile phone. To create a workable machine at a low price, many components and features had to be left off these devices. As a result, they lack many of the intuitive interface components that make other technology accessible. Those who wish to take advantage of their flexibility need to be prepared to engage in a process of trial and error. If used with that attitude, they can produce wonderful results.

Inexpensive cloud computing

For those seeking a more traditional, consumer-friendly interface that includes a monitor, keyboard and easy-to-use

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operating system, Chromebook might be the most popular and best-known option. Unlike the Raspberry Pi, the Chromebook is a proprietary low-cost laptop that is extremely user friendly. They retail for around $150 (€134). To keep their cost low, as well as to highlight the online ecosystem in which Google has already invested, the Chromebook is designed to be almost constantly connected to the Internet. Software and data storage, which are traditionally stored on the computer, are instead operated out of the "cloud". Using online servers is relatively commonplace for many individual applications, but the Chromebook highlights what is possible when online servers are an assumed feature of the entire operating system.

For instance, Chromebooks do not need much storage space because documents are saved and accessed online. These machines can also operate with relatively limited processing power, as most of the processing for their applications are done on server farms that the computer connects to through its Internet connection.

Running applications in the cloud also offers a number of other advantages. Cloud storage has built in security features that are constantly updated by the host and not dependent on the user running their anti-virus program. Should something happen to the operating system, it can be relatively easily deleted and re-installed. The entire Chromebook could even be stolen without its owner losing access to most data, because those data were never stored on the computer. Moreover, applications running in the cloud tend to be updated automatically and easily, as updates are handled on the central server by the provider.

Drawbacks to cloud computing

One significant drawback to all cloud-based devices is that these devices are truly functional only in places that have reliable access to the Internet. Without that access, they lose their capacity to perform many of their core tasks. While Internet penetration is increasing worldwide, it may be years, if not decades, before these computers become truly viable in some regions.

Cloud-based computing solutions also lack certain kinds of flexibility. Once a computer is dependent on the cloud, then its owner is also dependent on those running cloud services. For instance, Google is particularly well suited to design a cloud-based computer because it also operates a suite of cloud-based products, including a word processor, presentation software and image editing applications. Should Google decide to stop supporting one of these products, or make significant changes to one of them, then the user would have to find another way to accomplish the same goal. At the other end of the spectrum is the Raspberry Pi, which is ideally suited for experimentation and running custom-built software. Cloud-based solutions like Google's, however, are designed to operate as consumer experiences that work out of the box. As a result, they also offer relatively less customization.

Endless

Between the extremes of consumer cloud computers and extremely cheap microcomputers are efforts to build inexpensive computers specifically designed to meet the needs of areas with low-income populations. Toward meeting such a need, Endless has been under development for three years. It uses a custom operating system that is designed to focus on the specific needs of its target audience.

Starting at $169 (€152), Endless computers were also funded in part through Kickstarter and have just started shipping. They have the ability to access the Internet, but they are also self-sufficient without it. They come preloaded with over a 150 applications, including educational material such as encyclopedias and health applications. Endless computers are also designed to easily connect with existing television screens to allow for a large visual output device, without needing the expense of a dedicated monitor (Levine, 2015). Like Raspberry Pi, the operating system is based on Linux, but Endless has also been customized to take advantage of what is intuitive about tablet computing. The goal is for Endless to not only be powerful enough to allow for a wide variety of computing tasks, but also be accessible to those who are new to computers. Endless believes that it is more cost-effective way to design custom machine explicitly to meet these needs.

Conclusion: one laptop per child

Each one of these efforts represents a different pathway to making modern computing accessible to a wider audience by reducing its initial costs. Access to a computer can be a powerful tool for education, exploration and self-expression. At lower price points, microcomputers can allow for new, unprecedented innovation for institutions, such as libraries, as well as individuals who can afford to take more risks and stumble across new uses for the machines.

In this light, it is worth recalling the One Laptop per Child (OLPC) initiative, which began in 2005 with a mission to "provide each child with a rugged, low-cost, low-power, connected laptop". Originally funded through member companies that included AMD and eBay, the initiative was aimed at empowering children through technology. The OLPC enterprise understood that cost was a major barrier for many children around the world and that by reducing that cost they could have a transformative effect.

Yet, the effort ultimately faltered. Until April 2014, OLPCNews was an independent news blog and community that supported the OLPC effort. At this writing, their homepage points visitors to a new community, the Educational Technology Debate (Vota, 2014). Although still centered around similar aims, this transition highlights an important understanding that should underlie any conversation about computers: they are not just about the technology industry. Computers are tools that can provide access. They can be used to facilitate new forms of expression and access information. By using these tools to empower new literacies, libraries and others can continue to support their communities in a technology-driven age.

REFERENCES

Anderson, E. (2015), "Bill Gates named world's richest person for 16th time", *The Telegraph*, 2 March, available at: www.telegraph.co.uk/finance/economics/11445375/Bill-Gates-named-worlds-richest-person-for-16th-time.html (accessed 16 June 2015).

Downloaded by TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES At 21:27 10 November 2016 (PT)

DeLamielleure-Scott, C. (2015), "Library packs July with fun activities", *C&G Newspapers*, 1 July, available at: www.candgnews.com/news/library-packs-july-fun-activities-84433

Dunn, J. (2014), "Neil deGrasse Tyson: Bill Gates wouldn't bother picking up $45,000 off the ground", *Daily Genius*, 22 May, available at: http://dailygenius.com/neil-degrasse-tyson-bill-gates-wouldnt-bother-picking-up-45000-off-the-ground/

Enis, M. (2013), "White plains public library builds $50 OPAC terminals", *Library Journal*, Vol. 138 No. 5, p. 20.

Holing, W. (2015), "Raspberry Pi for educators and librarians", available at: www.techsoupforlibraries.org/blog/raspberry-pi-for-educators-and-librarians (accessed 12 March 2015).

Levine, B. (2015), "Picking up OLPC banner, startup unveils $169 computer for developing countries", available at: http://venturebeat.com/2015/04/14/picking-up-olpc-banner-startup-unveils-169-computer-for-developing-countries/ (accessed 17 June 2015).

Love, D. (2014), "Bill Gates says he would pick up $100 if he found it on the ground", available at: www.businessinsider.com/bill-gates-ama-video-2014-2 (accessed 2 July 2015).

Moore's Law (2015), "Wikipedia, the free encyclopedia", available at: https://en.wikipedia.org/w/index.php?title=Moore%27s_law&oldid=669132591

Nazario, K. and Suleman, K. (2015), "Raspberry Pi: top 15 projects to try yourself", available at: www.itpro.co.uk/mobile/21862/raspberry-pi-top-15-projects-to-try-yourself (accessed 12 March 2015).

Next Thing Co (2015), "CHIP – the world's first nine dollar computer", available at: www.kickstarter.com/projects/1598272670/chip-the-worlds-first-9-computer (accessed 12 June 2015).

Paul, I. (2015a), "10 insanely innovative, incredibly cool raspberry Pi projects", available at: www.pcworld.com/article/2895874/10-insanely-innovative-incredibly-cool-raspberry-pi-projects.html (accessed 29 June 2015).

Paul, I. (2015b), "BBC reveals micro: bit, a programmable PC that fits in your pocket", available at: www.pcworld.com/article/2944804/bbc-reveals-microbit-a-programmable-pc-that-fits-in-your-pocket.html (accessed 9 July 2015).

Pew Research Center (2015), "Cell phones in Africa: communication lifeline", Pew Research Center, available at: www.pewglobal.org/files/2015/04/Pew-Research-Center-Africa-Cell-Phone-Report-FINAL-April-15-2015.pdf

Vota, W. (2014), "Join us on educational technology debate", *OLPC News*, available at: www.olpcnews.com/about_olpc_news/join_us_on_educational_technol.html (accessed 2 July 2015).

Wells, M. (2014), "Addressing rural library technology budgets with single board computers: testing the APC 8950 rock circuit board computer for patron access", *Journal of Library Innovation*, Vol. 5 No. 1, pp. 1-12.

Wong, R. (2015), "C.H.I.P. – the super tiny computer that only costs $9", available at: http://mashable.com/2015/05/07/chip-tiny-computer/ (accessed 1 July 2015).

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