I, Librarian

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The fast and continuous technological change that is characteristic of the information society we find ourselves in has demonstrable impact on the way librarians go about their business. This paper offers a scenario of technological changes already in the pipeline and yet to come, and how those changes will impact the role of librarians in the future. One of the main concerns of this paper is the continued relevance of information professionals as infomediaries in our future society.

Will brick-and-mortar libraries still be relevant fifty years from now? Most librarians hope so but grudgingly acknowledge that this might not be the case—digital libraries are things we can wrap our minds around, albeit in a tentative way. Will flesh-and-bone librarians be relevant in fifty years time? Of course—the status of information professionals will grow in the information economy—surely we have established that. But will they be flesh and bone? Maybe not. Indications that service industries will not necessarily be populated by biological entities—as we know them—abound even now in areas outside the field of information science. While these may not be areas many information professionals venture into, such as gaming, cognitive science, artificial intelligence, and speculative fiction, still, the writing is on the wall. Librarians are already becoming more and more disembodied as their roles take them deeper into virtual environments.

When a user asks us for a journal article that is not housed on the library shelves and wants it *now*, we do not blink an eyelid. We go to the virtual shelf labeled EBSCO*host*, Emerald Insight, or Science Direct and produce the required article as effortlessly as we would a bound volume, without hesitation crossing the boundary between atoms and bits. When users come looking for annual reports, we simply point at the McGregors database and say, "you'll find it there." When we say, "just mail it to yourself," the thought of a post office doesn't cross our minds. Librarians already deal with many users in an exclusively virtual environment, having never met them face-to-face. We receive their e-mails and reply in kind, guiding them along URLs like so many familiar shelves.

I would like to create a picture of what I believe the future of librarianship holds.

Fragments from many sources were pieced together to assemble this picture. There are tidbits from magazines such as *Wired* and *Net Plus*, the speculative fiction novels of Gibson, Stephenson, and Noon; and the nonfiction works of Sterling, Brooks, and Johnson, among others. Also part of the mix are movies and anime such as Mamoro Oshii's *Avalon* and *hack//sign*; a myriad of Web sites and blogs—from Corante to SlashDot—and observations of reality (real and virtual). Martell contributed many ideas:

> No one can provide a picture of the future. This author can only offer pieces, but the pieces are significant. Some readers may not have thought a lot about them, but other readers have. The method is reductionist. The pieces are like those in a puzzle, but the reader will have to shape them to his or her specific reality and values. The image(s) being formed will change constantly as new information allows the reader to increase his or her understanding and intuitive connection to issues that are confounding, upsetting, and mind-bending.[1]

I see my fragments as a collage—a picture made by fixing various materials to a surface—rather than as a puzzle with a predetermined image. This collage of the future is made up of images from fiction and nonfiction, real life and virtual life, all of which elements will be included in this paper, often juxtaposed to show how boundaries are blurring. It will be difficult to maintain rigid boundaries between fiction and nonfiction, considering that, in our fast-changing environment, the only thing separating the two might be a few months. To quote Sterling, "people who 'predict the future' must always tell fictions—even if they happen to tell the truth."[2]

An example:

In 1999, Gibson published his novel, *All Tomorrow's Parties*, describing a world "just a breath away from the here and now":

> At another kiosk, he uses it to buy a disposable phone good for a total of thirty minutes, Tokyo–LA.
>
> He asks his notebook for Rydell's number.[3]

Cut to December 2001, and *Wired* introduces the "Hop-On":

> Vending-machine cell phones once existed only in William Gibson's fiction. Now thirty bucks gets you sixty minutes of prepaid U.S. airtime using Hop-On's disposable, recyclable cell.[4]

Another example:

In 1992, *Snow Crash*, Stephenson's "mall mythology for the early 21st century" is published. In it he describes a nifty piece of software called Earth:

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There is something new: A globe about the size of a grapefruit, a perfectly detailed rendition of Planet Earth, hanging in space at arm's length in front of his eyes. Hiro has heard about this but never seen it. It is a piece of CIC software called, simply, Earth. It is the user interface that CIC uses to keep track of every bit of spatial information it owns—all the maps, weather data, architectural plans, and satellite surveillance stuff.[5]

Ten years later Ambient introduces the Ambient Orb:

The Ambient Orb may look like a crystal ball on acid, but it's really more of a giant mood ring—plugged straight into the fluctuations of the stock market or anything else you care to track. The orb can be wirelessly configured to track any individual stock, any market index, or your personal portfolio.[6]

And then of course there is the inimitable ASIMO:

Honda believes it won't be long before robots are part of our everyday lives. ASIMO, our fast-evolving two-legged robot already walks just like a human, even up and down slopes and stairways. At 120 cm and 52 kg, ASIMO is the right size for unobtrusive service to society—a dream long depicted in science fiction.[7]

Using ideas from works of fiction—more specifically, speculative fiction—may appear fanciful to some. But when one looks at the projects with which bright minds at institutions like the MIT Media Lab occupy themselves, the ideas found in speculative fiction seem almost everyday by comparison. Consider projects such as: programmable bricks, music creatures, interfacing electronics to living plants, beat-bugs, illuminating clay, chameleon cars, expressive footwear, objects with attitude, and my personal favorite, Elvis—a situation-aware conversational chandelier.[8] Gibson's smart sunglasses pale by comparison.

Being neither computer scientist nor hacker, descriptions of innovations will be rudimentary, with more focus on the relevance of these innovations for information professionals. Further, freely admitting to not having read enough Baudrillard or McLuhan, no attempt will be made to philosophize deeply on the topic. Taking to heart Brooks's admonition "it is foolish, arrogant, and unwise to try to predict the future very far at all. And anyone who tries is doomed to fail," the author's speculations will not venture "beyond just a handful of years."[9] This paper will tell one story, create one scenario, of a possible future. There is room for many.

The Future

Most of our predictions are based on very linear thinking, and that is why they will likely be wrong. Technology follows exponential curves.[10]

Kurzweil, inventor and futurist, argues that it is not only change that is accelerating, but that the pace of the acceleration is itself accelerating. He states that, within forty to fifty years, change will exceed our ability to grasp it:

Things are going to move at a pace beyond what we can now comprehend. People may not even notice it, because in its wake it will leave a very good facsimile of the real world. But this affects everything. It affects the very nature of human intelligence. We'll see intelligence that's derivative of human intelligence, but superior to it.[11]

For many, the changes occurring today are already difficult to comprehend. However, failing to familiarize oneself with the changes that most likely will have a direct effect on our profession is a grave oversight. It is difficult to take a mind-leap into the future, but certain trends are clearly discernible, and a good starting point might be to keep these in mind when the words *impossible* and *never* inevitably surface. To highlight just a few:

- decreasing hardware costs leading to larger memories and faster systems;
- miniaturization of hardware leading to portability;
- new display-technologies leading to the packaging of computational devices in new forms;
- assimilation of computation into the environment (VCRs, microwave ovens);
- increased development of network communication and distributed computing;
- increasingly widespread use of computers, especially by people who are outside of the computing profession;
- increasing innovation in input techniques (voice, gesture, pen); and
- wider social concern leading to improved access to computers by currently disadvantaged groups.[12]

A good place to start stretching our minds might be with a technology that is steadily burrowing its way into our lives via the Web—the Intelligent Software Agent (ISA).

ISAs

On the Web, an agent is "a program that gathers information or performs some other service without your immediate presence and on some regular schedule. Typically, an agent program, using parameters you have provided, searches all or some part of the Internet, gathers information you're interested in, and presents it to you on a daily or other periodic basis."[13] Having an agent methodically crawling the Web, gathering the information you've specified, is a bit like having a full-time reference librarian residing in your PC. Into an environment where information overload is the bane of every information user and profes-

sional, enter the intelligent agent who has no quibbles about collecting information 24/7—more than can be said of even the most energetic information professional:

> Many of the features that make the World Wide Web . . . useful are also time consuming and laborious. Tasks such as searching for a particular item of information, or keeping abreast of developments in a specific field of interest, can be automated. . . . intelligent agents can trawl the World Wide Web, searching out content that is relevant to a user's needs; some can learn a particular Internet user's interests, and download relevant content.[14]

Together with the ability to customize the tasks of an agent will be the ability to customize its interface. Not only will your personal information agent do your bidding in information space, but you can also specify how you want your in-house librarian to look.

█ Avatars

Kurzweil is confident that virtual personalities will be an increasingly familiar phenomenon in the near future.[15] More and more interaction will take place between humans and virtual entities created with a visual presence and human voice. Initially, these entities will function well within a limited area; for example, with regards to a specific product where questions and answers about the product are finite.

In a library set-up, virtual personalities may be the ideal trainers. If they are issued as part of a specific database, chances are that they will always be able to answer any question related to the intricacies of the software under discussion (often more than can be said of human information professionals). Moreover, they can be programmed to deliver training according to different levels of expertise—from the novice to the advanced user, most likely in the preferred language of the trainee. The logistical problems many trainers will be familiar with, such as finding a suitable venue or time, may soon be something of the past. The ACM Special Interest Group on Computer-Human Interaction is convinced that this kind of "user tailorability" will be one of the expected characteristics of future human-computer interaction [HCI]:

> Ordinary users will routinely tailor applications to their own use, and will use this power to invent new applications based on their understanding of their own domains.[16]

Many information professionals may agree that a large chunk of their time—maybe even the bulk—is spent answering a limited set of routine or factual questions: do you have an article by this author, a book on this topic,

this specific journal? A virtual librarian with direct access to a multitude of databases will have no problem answering any of these questions, and probably much faster than any biological librarian.

In *Snow Crash*, speculative fiction writer Stephenson's avatars strut their stuff in cyberspace:

> He is not seeing real people, of course. This is all part of the moving illustration drawn by his computer according to specifications coming down the fibre-optic cable. The people are pieces of software called avatars. They are the audio-visual bodies that people use to communicate with each other in the Metaverse.[17]

Seemingly a big fan of real-life librarians, Stephenson did not let the chance pass to create a librarian for his virtual reality Metaverse:

> The Librarian daemon looks like a pleasant, fiftyish, silverhaired, bearded man with bright blue eyes, wearing a V-neck sweater over a work shirt, with a coarsely woven, tweedy-looking wool tie. The tie is loosened, the sleeves pushed up. Even though he's just a piece of software, he has reason to be cheerful; he can move through the nearly infinite stacks of information in the Library with the agility of a spider dancing across a vast web of cross references.[18]

In *Mona Lisa Overdrive*, the futurist novel by Gibson, one of the central characters receives a "Maas-Neotek biochip personality-base programmed to aid and advise the Japanese visitor in the United Kingdom":

> "I know all sorts of things," he said, and went to one of the dormer windows. "I know that a serving table in Middle Temple Hall is said to be made from the timbers of the Golden Hind; that you climb one hundred and twenty-eight steps to the walkways of Tower Bridge; that in Wood Street, right of Cheapside, is a plane tree thought to have been the one in which Wordsworth's thrush sang loud. . . . " He spun suddenly to face her. "It isn't, though, because the current tree was cloned from the original in 1998. I know all that, you see, and more, a very great deal more."[19]

Farfetched? A real-world counterpart for the Maas-Neotek biochip personality-base is currently being developed as part of the Fifth European Community Framework Programme, covering research, technological development, and demonstration activities:

> TOURBOT—Interactive Museum Tele-presence Through Robotic Avatars. The goal of TOURBOT is the development of an interactive tour-guide robot able to provide individual access to museums' exhibits and cultural heritage over the Internet. TOURBOT operates as the user's avatar in the museum by accepting command over the web that direct it to move in its workspace and

visit specific exhibits; besides, TOURBOT can also act as a flexible, on-site museum-guide.[20]]

One might argue that any user would prefer a flesh-and-blood librarian to a machine. It bears keeping in mind, though, that the user of tomorrow—the screen-ager/Web-ster/protean/Gen Y-er of today—will much likely be more familiar with Ninjai, Deunan, and Blood Rayne (or whatever cyber-star will be the flavor of the month) than with the inside of a bricks-and-mortar library. We are already seeing "e-teens to whom interactivity is an incontrovertible modus operandi";[21] children who "spend as much time with fictional characters on television, film, and in cyberspace as they do with peers in real time."[22] According to Nua Internet Surveys, "six out of ten children in the UK know that homepage was the front page of a Web site, whereas only nine percent could explain what the preface to a book was."[23] It might even be that these future users would be uncomfortable dealing with someone who tries to mediate between them and the information available—information professionals are familiar with the increasing number of users who prefer to do it themselves.

So not only might these software agents be better looking than your real-world librarians, they will be more comfortable in the world of bits and bytes—information is, after all, their natural habitat. If the predictions of Berners-Lee, the man whose pioneering work led to the creation of the Web, are anything to go by, a new form of Web content that is meaningful to "V-humans" is evolving as we speak. The semantic Web will be the information environment where ISAs can reach their full potential.

The Semantic Web

Berners-Lee predicts that "the semantic Web will bring structure to the meaningful content of Web pages, creating an environment where software agents roaming from page to page can readily carry out sophisticated tasks for users."[24] In essence, the semantic Web will mean that semantics get encoded into Web pages when they are created. Concepts on the Web will explain their meaning to the software agents they come into contact with, allowing for context-specific searching. It sounds almost too good to be true, but the technologies for developing the semantic Web already exist. eXtensible Markup Language (XML) allows the creator of a Web page to create hidden tags to annotate preferred concepts; the Resource Description Framework (RDF) facilitates the standardization of the tags used, while ontologies formally define the relations among terms.

It may sound very involved, but then we all thought designing a Web site was difficult until we discovered Dreamweaver and all the other off-the-shelf WYSIWYG software that does all the hard work for us. The semantic Web will allow software agents to improve the accuracy of their search results by specifying precise tags. The user may, for example, instruct his or her agent to search only for novels by a specific author and to ignore all poetry published by the same author. Or the user may instruct the agent to search only for novels by the author written within a specific genre, the type of query that currently would require a librarian to build a bibliography from various different sites and databases.

And when the agent has done its/his/her job, and found all the highly relevant results, the user can just go and collect it—in cyberspace . . .

> "Your information, sir," the Librarian says.
>
> Hiro startles and glances up. Earth swings down and out of his field of view and there is the librarian, standing in front of the desk, holding out a hypercard. Like any librarian in Reality, this daemon can move around without audible footfalls.[25]

Virtual Worlds

> There is no there, there.
> —Gertrude Stein

While some view full-immersion virtual reality as a world that will never come to be, others are working actively towards its realization.[26] Then there are, of course, those who spend the bulk of their time traversing the continents of Odus, Antonica, Faydwer, Kunark and Velious—the World of Narrath, or exploring the cities and villages of Britannia such as Minoc, Moonglow, Yew, Trinsic, and Cove. These graphical 3-D virtual worlds are home to those engaging in massively multiplayer online games such as EverQuest and Ultima Online—entire virtual environments "with [their] own diverse species, economic systems, alliances, and politics."[27]

While there is still much work to be done before full-immersion virtual reality becomes commonplace, Stephenson's Metaverse is appearing less fictitious already:

> Hiro is approaching the Street. It is the Broadway, the Champs Élysées of the Metaverse. It is the brilliantly lit boulevard that can be seen, miniaturized and backward, reflected in the lenses of his goggles. It does not really exist. But right now, millions of people are walking up and down it. . .
>
> The only difference is that since the Street does not really exist—it's just a computer-graphics protocol

written down on a piece of paper somewhere—none of these things are being physically built. They are, rather, pieces of software, made available to the public over the worldwide fiber-optics network. When Hiro goes into the Metaverse and looks down the Street and sees buildings and electric signs stretching off into the darkness, disappearing over the curve of the globe, he is actually staring at the graphic representations—the user interfaces—of a myriad different pieces of software that have been engineered by major corporations.[28]

Wearable Computing

And how will we access our virtual abode of choice? Those in the know believe that wearable technology will be the way to go and that this will enable us "to be in visual and auditory virtual reality at all times."[29] Scientists at NASA who are creating Body Wearable Computers (BWCs) at the Kennedy Space Center, define a BWC as a "battery-powered computer system worn on the user's body. . . . It is designed for mobile and predominantly hands-free operations, often incorporating head-mounted displays and speech input."[30] What the reputable scientists at NASA define as their "borg" is virtually indistinguishable from the fictional gargoyles that Stephenson describes in *Snow Crash*:

> Gargoyles represent the embarrassing side of the Central Intelligence Corporation. Instead of using laptops, they wear their computers on their bodies, broken up into separate modules that hang on the waist, on the back, on the headset . . . Gargoyles are no fun to talk to. They never finish a sentence. They are adrift in a laser-drawn world, scanning retinas in all directions, doing background checks on everyone within a thousand yards, seeing everything in visual light, infrared, millimeter-wave radar, and ultrasound all at once.[31]

And back in the real world? Microsoft, in conjunction with watchmakers Fossil and Suunto, offers us its Smart Watch with MSN Direct that "combines technology and style to deliver personalized information at the flick of a wrist."

It may sound awkward at the very least to operate in two realities simultaneously, but Cochrane reminds us of the amazing ability we as a species have to multitask—"to live in more than one world at once through multiple visual and acoustic inputs."[32] He cites the example of reading a newspaper while listening to the radio. In an environment where speed is of the essence, the ability to access information immediately from anywhere will mean a huge competitive advantage for those using it.

Think 24/7-access with the convenience of having a software agent—"a personal librarian roaming global data banks on our behalf"—and other options, such as visiting or even phoning a real library, begin to look increasingly counterproductive.[33]

Machine Intelligence

Raise the issue of artificial intelligence and most people's involuntary response is no, never. In his thought-provoking article, "The Disembodied Librarian in the Digital Age," Martell argues, "It is not easy to adapt to a change that impacts our system of values. The consequences can be profound. We may lose sight of who we are. We may lose our sense of purpose and meaning."[34]

Still, he warns against ignoring the discontinuities—such as that between humans and technology—that will have an incalculable influence on our institutions:

> The common view among librarians is that the changes in their profession are following an evolutionary, rather than a revolutionary, pattern. From this perspective, relatively few adaptations will be required of them. However, this vision is too narrow. It overlooks fundamental dislocations occurring throughout the world. These will alter what it is to be human, both conceptually and consciously.[35]

In his article on what he calls "alien intelligence," Martin urges that "it is time to give up the 20th century notion that artificial intelligence will be like human intelligence. Instead, the early stages of new forms of computer intelligence exhibit characteristics that are radically different from human intelligence."[36] He defines this alien intelligence as ". . . processes, executed on a computer, that are of such complexity that a human can neither follow the logic step by step nor come to the same result by other means."[37]

At this stage, it is evident that the capabilities of people and machines are very different. In terms of the objectives of libraries, both real and virtual, I believe that the capabilities of machines are increasingly suited to achieving such objectives in the information society. When looking at the contrasts between the capabilities of the human brain and the computer, the computer is infinitely better suited to the environment in which the bulk of research takes place—cyberspace. Using Martin's list of contrasts as a starting point, the direct capabilities a computer can call upon to deal with a request for information include:

- Very high speed logic
- Absolute accuracy
- Vast data warehouses

- Data stored in systems world-wide (precise cooperation with other machines)
- Worldwide connectivity (immediate worldwide inter-linkage)
- Fast, accurate communication with many locations[38]

In contrast, humans think relatively slowly, they are prone to make mistakes, they have limited memory, they are located in one specific place, and they communicate slowly and often imprecisely. What humans do have to offer is the ability to think about meaning and purpose, originality and commonsense. Unfortunately for librarians, many information seekers are looking for factual pieces of information and data—not wisdom—as quickly as possible, and machines are all too able to fulfill this need.

Warwick emphasizes the suitability of machine intelligence to the informational society:

> In the Western world humans have undeniably created a technologically based society that functions with computers and machines at its core. Humans evolved to cope well as hunter-gatherers, yet in a short space of time we have created a society that not only thrives on information, but depends on it as its lifeblood.
>
> Human intelligence has great difficulty in coping with this new environment. Quite simply, far too much information exists for us to even remotely hope to grapple with. It is computers that are really suited to this information age, with their ability to think in many dimensions and deal with many variables and inputs. Human intelligence evolved in a world which no longer exists.[39]

Conclusion

> The future is already here; it's just unevenly distributed.
> —attributed to William Gibson

Referring to Gibson, Martell argues that "the chasm between his images of the future and the visions of the future as depicted in library literature is enormous. And this is worrisome."[40] What this paper attempted was to bring more images of the future to the puzzle Martell started. Some of the pieces might not fit anywhere into the puzzle, and we can throw them away. But from the picture already visible, this author suggests we keep all the pieces with ISAs, and all the pieces with virtual personalities and worlds, and maybe even the ones on machine intelligence. And if we all strap on our wearable computing ware and arrange to meet somewhere in cyberspace, we may yet complete the picture.

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