

AN EVOLVING SCHOLARLY SERVICE SYSTEM: A NEW HORIZON OF PEOPLE AND MACHINE INTERACTION

Md Abul Kalam Siddike¹

Youji Kohda²

Graduate School of Knowledge Science

Japan Advanced Institute of Science and Technology, Japan

kalam.siddike@gmail.com

ABSTRACT

An evolving scholarly service system is the ultimate future of e-readers for the academics and research communities. We conceptualize an evolving scholarly service system as socio-technical systems in which people use human assistive technologies to automatically generate summarization of their required information. In this paper, first of all, we showed the global trends of e-readers, human assistive technologies and finally, we proposed an evolving scholarly service system. In this evolving scholarly service system, academics and researchers automatically receive the reading and summarizing services by the scholarly advisory assistants. This paper concludes with practical implications and future research directions.

Keywords: *Service systems, scholarly service systems, human and machine interactions, e-readers, human assistive technologies*

RESEARCH BACKGROUND

A service system is the configuration of people, technologies, organizations and shared information (Spohrer et al., 2008; Maglio et al., 2009). Technologies are continuously sophisticated in terms of bringing new services or offering new services or processing of new services. As a result, human interactions with technologies are also continuously changing. Therefore, service systems are also changing. Apple Siri, Google Home, Amazon Echo, Microsoft Crotona, and IBM Watson are notable examples of human assistive technologies or artificial intelligence or cognitive computing (Spohrer & Banavar, 2015). Some of these can augment human capabilities in limited ways and some of them are powerful.

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For example, Google Home and Amazon Echo are same in terms of offering services but Google Home are more powerful and can do a lot of work for people. Noticeably, IBM Watson cognitive computing has the mighty power to search and generate precise recommendations for humans (Kelly III and Hamm, 2013).

Apple iPod has changed the way we listen music. Digital TV recorders have changed the way we watch TV. Similarly, human assistive technologies change the way, how people and machine co-operatively interact for augmenting human intellect to address complex, and urgent problem (Engelbart, 1962). On the other hand, e-readers provide paperless reading services to the academics as well as for everyone in the society (Li, 2008). Then, what impact will the e-readers have, when augmented by human assistive technologies (backed up by artificial intelligence) especially in the academia and research communities? Therefore, the main objectives of this paper are to describe the current trends of human assistive technologies; discuss the global trends of e-readers. After that, we propose a framework of scholarly service systems for the harmonious interaction between people and machine.

The rest of the paper is organized in the following ways: Section 2 discusses the current trends of human assistive technologies; Section 3 describes the e-readers used by the human and the possibilities of human assistive technologies in education and research; Section 4 proposes an evolving scholarly service system; and Finally, Section 5 concludes the paper with practical implications and future research directions.

HUMAN ASSISTIVE TECHNOLOGIES

In this paper, the term “*human assistive technologies*” is similar to “*cognitive assistants*” or “*cognitive systems*”. Human assistive technologies are new decision tools, able to augment human capabilities and expertise understanding the environment around us with a depth and clarity (Spohrer & Banavar, 2015; Kelly III & Hamm, 2013; Spohrer, 2016). In addition, human assistive technologies can provide people with high-quality recommendations and help them make better data-driven decisions (Demirkan et al., 2015). Furthermore, human problem solving capabilities significantly augmented by the interaction of humans and machine. It will help humans to achieve deeper insights from huge amounts of structured and unstructured data (Spohrer & Banavar, 2015). Therefore, humans think big data as a *natural resource* waiting to be mind. And in order to tap this vast resource, humans

need computers that “think” and interact more like humans do (Kelly III & Hamm, 2013). Human assistive technologies learn, adapt and interact with humans for augmenting human capabilities to take better decision for solving complex problems in human life (Spohrer & Banavar, 2015).

Human assistive technologies can potentially progress from tools to assistants to collaborators to coaches, and be perceived differently depending on the role service system entities play in a service system. In this case, cognitive systems acquire better and better models of their users and more expert cognitive and social capabilities (Spohrer, 2016). Forbus (2016) articulated that AI achieved social organisms through apprentice providing some form of works, with roles and responsibilities allowing AI entering into human culture. In this case, apprenticeship can allow AI to achieve some roles and responsibilities of human culture. Furthermore, Lenat (2016) predicted the future of AI providing “*weak telepathy*” (AI understands what you have in mind and why, and completes that action), “*weak immortality*” (even after your death, it can continue to interact with loved ones, friends, business associates, carry on conversations, carry our assigned tasks and others), and “*weak cloning*” (refers to the science fiction type of duplication of you instantly as you are now, able to be in several places at once). Finally, Spohrer (2016) predicted that with the help of a cognitive assistant, a young adult in 2055, could have the ability and the experience to rapidly rebuild societal infrastructure from the scratch. Spohrer and Banavar (2015) present two dozen examples of human assistive technologies, from chefs to CEOs, and from day care workers to doctors. In the next section, we present the current trends and use of human assistive technologies.

Global trends of human assistive technologies

Table 1 highlights some of the recent growth of industrial strengths of human assistive technologies which can be found in the diverse offering from many companies all over the world (Spohrer & Banavar, 2015).

Table 1

Human assistive technologies

Name of assistive technologies	Developed by	Year
Ginger	Intel	2007
Siri	Apple	2011

Watson	IBM	2011
BlackBerry 10	BlackBerry	2013
Cortana	Microsoft	2014
Google Home, Google Now	Google	2016, 2012
Echo	Amazon	2014
Viv the global brain	Viv	2016

Ginger, an Israeli language enhancement assistive technology founded towards the end of 2007 and acquired by Intel in 2014. For smartphones, Siri was originally introduced by Siri Inc. and acquired by Apple in 2010 and introduced as a feature of the iPhone in 2011. And the makers of Siri, debuted Viv (global brain) in 2016. After that in 2011, the Watson Jeopardy! DEEP-QA system compete the human intelligence and in 2014, IBM introduced the era of cognitive computing (Spohrer & Banavar, 2015). In this way, another tech giant Microsoft created Cortana in 2014 as a key ingredient of Microsoft's operating system. In 2014, Amazon introduced voice-enabled assistant namely Amazon Eco. Recently, Google introduced the same technology like Amazon Echo in 2016.

Use of human assistive technologies

Human assistive technologies used for different purposes. Some of them can augment limited amount of human intelligence and some of them are more powerful. These human assistive technologies are developed for different professions. The use of these human assistive technologies are summarized in Table 2.

Table 2
Use of human assistive technologies

Technologies	Usages of Human Assistive Technologies
Apple SIRI	-Siri as a friend and it can help get things done — like sending messages, placing calls, and making dinner reservations.
	-Humans can ask to show the best route home.
	-Humans can talk with Siri to set alarm and ask questions.
	-Human voice be the remote control for connected products.
	-Siri can be tuned in the world working with Wikipedia,

	Yelp and other online service for getting more answers. -Watson Engagement Advisor interacts with customers, listens to questions and offers solutions. -Watson Explorer accesses and analyzes structured and unstructured content. -Watson Discovery Adviser makes connections and draws relationships between data for everyone's activities. -Watson for Oncology analyzes a patient's medical information against a vast array of data and expertise to provide evidence-based treatment. -Watson for Clinical Trail Matching enhances clinicians' ability to more easily find the potential list of clinical traits.
IBM Watson	
Google Now	-Uses for answering questions, make recommendations, and perform actions by delegating requests to a set of web services. -Deliver information to users
Google assistant	-Google Assistant is the evolution of Google Now. -It can engage in two-way dialogue with the user. - A voice-activated home product, allows family to get answers from Google, stream music, and manage everyday tasks.
Google Home	-it can set reminders -speak our mind -can use maps
Microsoft Cortana	-can dictate emails -can search terms -can show flight information -can provide news feeds -it is capable of voice interaction; -music playback; -making to-do lists;
Amazon Echo	-setting alarms; -streaming podcasts; - playing audiobooks; -providing weather, traffic and other real time information;

	-can also control several smart devices using itself as a home automation hub.
Viv the global brain	-can accommodate external plug-ins written to work with the assistant.
	- can also handle more complex queries

(Sources: different websites and secondary sources)

TRENDS OF E-READERS

E-reader is a portable device, provides reading facilities for students, teachers, engineers, scientists and all kinds of people in our society. An e-reader provides quickly and easily access to the internet and download information when travelling (Li, 2008). In addition, e-readers improve the reading experience by providing access to more information or to richer forms parallel information through build-in dictionaries, hyperlinks, and text-to-speech functions (Stone, 2008). Furthermore, it also provides supports for audio files, e-ink technology that makes the reading experience that of reading a printed book. Furthermore, it provides listening music while reading. It is to be noted that most of the renowned e-readers have their own platforms to provide reading facilities to the users. In this section, we will focus on current state of e-readers, features and the future of e-readers in this age of human assistive technologies.

Current state of e-readers and tablets

Currently, Amazon Kindle, Sony Reader, Kobo Reader and Nook are the most popular e-readers in the market. Figure 1 and Figure 2 represent the e-reader devices and tablets for reading purposes in the United States. The report shows that Kindles are the most popular type of e-reading device, and are owned by 62% of those who own e-readers. Another 22% own a Nook, making it the second most popular type (Rainie et al., 2012).

In case of using Tablet computers for reading purposes, iPad is the most popular device also used for e-reading purposes and owned by 60% who used for e-reading purpose. Another 14% owned by Amazon Kindle Tablet, making it the second most popular type for reading e-books (Rainie et al., 2012).

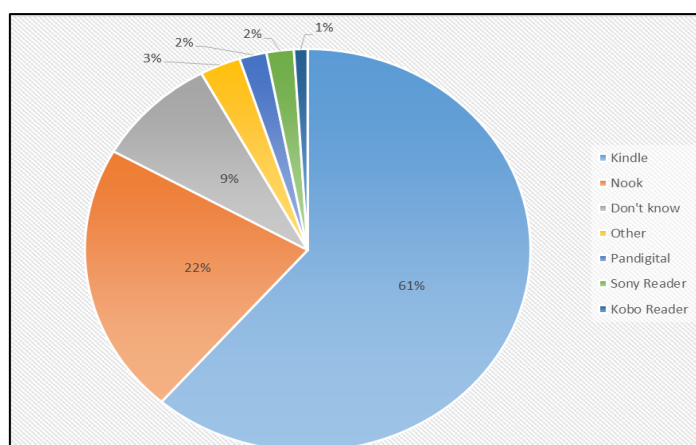


Figure 1
American adult e-reader owners

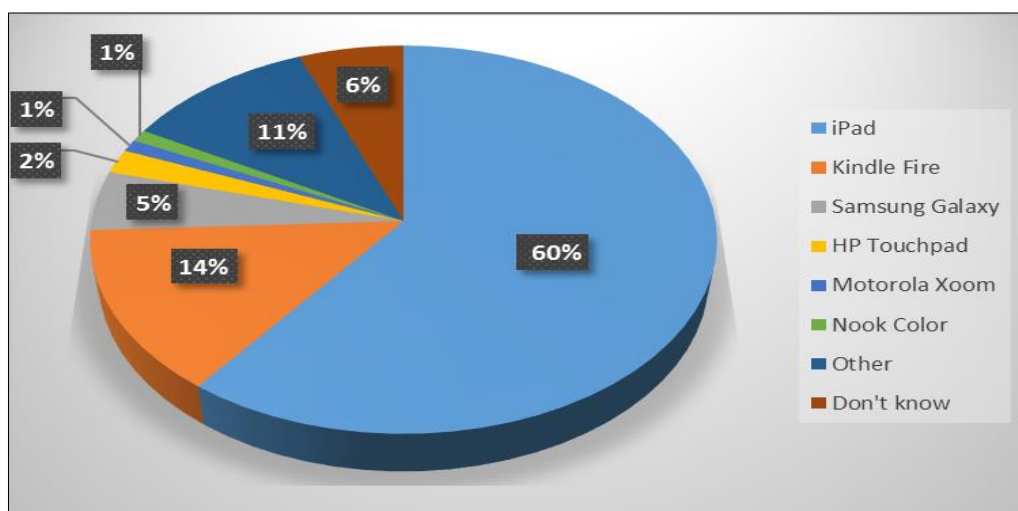


Figure 2
Tablet computers use for e-reading purposes (Rainie et al., 2012)

Use of e-readers

Almost all of the popular e-reader devices have the same type of features that make them attractive to the users all over the world. Table 3 shows the most common features of some popular e-reader devices.

Table 3
Common features of e-readers

Name of e-readers	Use of e-readers
Amazon Kindle	-Easy on eyes—touchscreen display that reads like real paper.

	-No screen glare, even in bright sunlight. -Lighter than a paperback, holds thousands of books. -Have a massive selection of titles. -Actual ink particles and proprietary, hand-built fonts to create crisp text similar to what we see in a physical book. -Adjustable text size -Can share one's own Kindle books with family and friends. -Able to flip notable passages in remind ourselves of what's happened in the book. -With a single tap, we can read the complete text of each footnote without losing our place in the book. -Provides translation services instantly into other languages. -Transforming contents from the computers. -Access Wi-Fi network; access reader store; browser for internet access; check out e-books from public libraries; use Evernote and Facebook. -Provides bookmarks, words highlight and handwrite notes on a page.
Sony Reader	-Search options with notes, pages with a keyword and search content via keyword. -Dictionary—look up words while reading; look up words in a dictionary; list of previously list-up words -Also provide had writing, text memo, picture viewer, Evernote and Facebook. -It has lightweight and it also portable -Dozens of custom font types and sizes.
Kobo	-Built in ComfortLight for better nighttime reading. -An anti-glare, book-like screen. -Months of continuous battery life. -Note-taking and highlighting capabilities. -Sharing capabilities—users can share books with their friends and families.
Nook	-Compatible with Android OS and Google's operating system written for mobile devices. -Provide dual display features—black and while E Ink

screen as well as color capacitive touchscreen.

-Provide access to 3G and Wi-Fi

Future of e-readers

The popularity of e-reading is increasing but the use of e-readers is not increasing at the same speed due to availability of alternative devices like smartphones. Therefore, what is the future of e-readers? On the other hand, several human assistive technologies are in the market for augmenting human capabilities (Spohrer & Banavar, 2015). Currently, human assistive technologies used by doctors, bankers, travelers, and other occupational people (Spohrer, 2015). Recently, initiatives have been taken to utilize the power of cognitive computing in education and research. Deakin University in Australia, used the offerings of IBM Watson Engagement Advisor for enhancing student engagement and experience and provides a Student Advisor application enabling Deakin constituents to get real-time, 24/7 answers to any questions (Eassom, 2015; Smith, 2014; IBM, 2014).

Quality teaching is critical to effective education. Yet, teachers often lack the opportunities and resources for professional development to improve their classroom skills. Codename: Watson Teacher Advisor, an application of IBM Watson to the profession of teaching holds great promise in strengthening teaching across the United States, with potential application in other areas of the world. In addition, human assistive technologies can also be used to help research process vast amounts of information. Furthermore, scientists can also use the human assistive technologies to breakthrough in innovations and research (IBM, 2014).

As a result, if the e-readers' technologies are backed up by the mighty power of human assistive technologies, then what kinds of services we can expect from e-readers? Therefore, the next section of this paper, we propose an evolving scholarly service system that will ultimately be the future of education and research.

PROPOSED SCHOLARLY SERVICE SYSTEM

In this section, we propose an evolving scholarly service systems backed up by the might power of human assistive technologies. First of all, we show the traditional service systems in e-readers. Secondly, we describe the proposed scholarly service system and finally, we discuss the structure of the proposed service system.

Traditional service systems in e-readers

Figure 3 represents the traditional view of service systems in e-readers. In this case, people's interaction with the e-readers is one dimensional or one way. Only people can read and write, and listen music while reading. In addition, people can listen the audio recoded book reading using the e-readers. Furthermore, e-readers provide access to internet for searching and browsing of book titles.

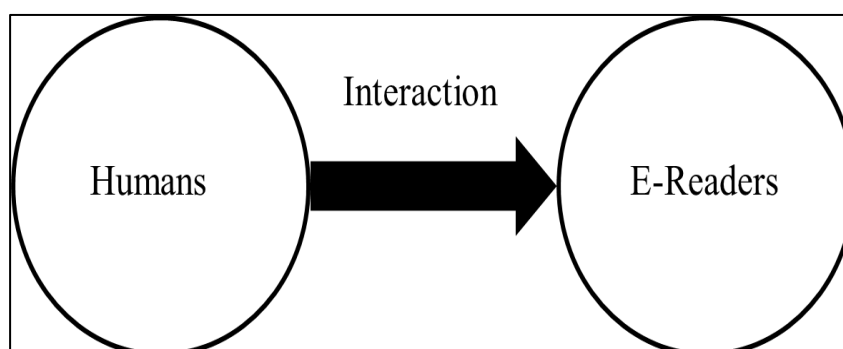


Figure 3

Traditional service systems in e-readers

Proposed scholarly service systems

Figure 4 represents our tentative proposed scholarly service system. In this service system, people's interaction with machine will harmoniously be augmented by the mighty power of cognitive computing or artificial intelligence or human assistive technologies. Here, people will receive reading facilities and can also ask the machine for helps or request for summarization (review of literature) of knowledge in a specific domain. Then, the machine will be able to provide summarization service or answering services for people that will be greatly helpful for students, teachers, scientists, engineers, doctors, bankers, tourists as well as other professional people to research, create knowledge, and apply knowlege for co-creation of values.

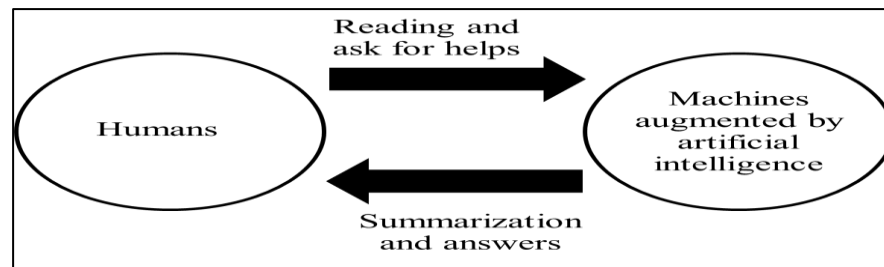


Figure 4
Proposed scholarly service systems

Structure of the proposed scholarly service systems

Figure 5 shows a tentative structure of the proposed evolving service system. People, human assistive technologies and ecosystems are the main three components of the proposed evolving service system. In this structure, first of all, almost all the professional people namely students, teachers, researchers, scientists, engineers, doctors, tourists and bankers request for assistant to human assistive technologies. Secondly, human assistive technologies have the mighty power to process the real world unstructured and structured data and generate precise recommendations for the people. Thirdly, human assistive technologies can also access to a larger ecosystems consisting of book databases, social networking databases, several cloud platforms, and journal databases as well as all kind of other platforms. Using the mighty power of machine learning, deep learning as well as AI, human assistive technologies can generate precise recommendations and provide feedback to human. In this ecosystem, book databases consist of Amazon, Google, iBook, Kobo's book databases, and other book databases all over the world. Furthermore, social networking sites (Facebook, Twitter, and LinkedIn), several cloud companies (IBM cloud, Google cloud and other cloud) and all kinds of journal databases as well as other types of databases consist of the ecosystems.

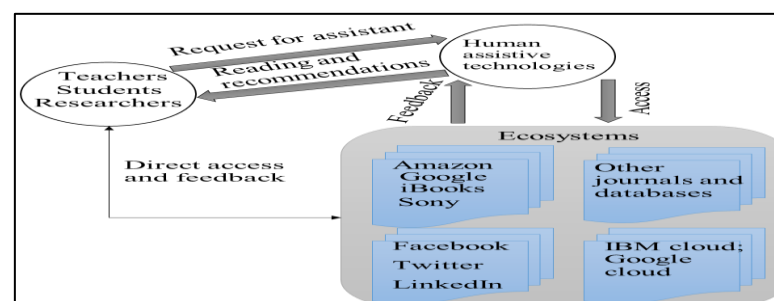


Figure 5
Structure of scholarly service system

In this way, human assistive technologies will be able to summarize the trillions of data and provide appropriate options for academics, researchers, scientists and engineers for conducting new innovations in the world.

DISCUSSIONS AND FUTURE RESEARCH DIRECTIONS

Our proposed evolving scholarly service system is a new way of thinking about the future as explained earlier and depicted in figure 5. The evolving scholarly service system boosts the creativity and productivity of students, teachers, and researchers and accelerate discoveries (Spohrer & Banavar, 2015). Furthermore, this scholarly service system will be able to provide quick summarization (review of literature) for every student, teacher and researcher in the world that will greatly augment people capabilities for co-creation of value.

With the help of our proposed scholarly service system, our next generation will be able to build and re-build from the scratch (Spohrer et al., 2017). In addition, our scholarly service system allows people of all ages to design, build, understand, and work harmoniously with technologies to augment human capabilities to address the complex and urgent problems (Engelbart, 1962). Furthermore, it will address some of the problems associated with “*bounded rationality*” in decision making—the condition noted by Herbert Simon (1997) and “*knowledge burden*” (Jones, 2005) as well as “*half-life of objects*” (Arbesman, 2013). In service science, these problems are dealt with creation of knowledge, application of knowledge and practice of knowledge (Spohrer et al., 2013). Moreover, engineers also solve these problems by innovating and discovering new things (Boulding, 1956). There are several limitations of our proposed evolving scholarly service system. First of all, our proposed scholarly service system is conceptually developed based on the existing literature on human assistive technologies and e-readers. Therefore, the followings are the open questions for the system sciences and engineering community:

- What are the impacts of current e-readers?
- How human assistive technologies are being used by different professional people?
- How human assistive technologies harmoniously interact with people?
- What will be the strategies in the evolving service systems?
- How we can provide entities’ rights and responsibilities of the evolving scholarly service system ecology?

- What kinds of social and economic values will be co-created in the evolving scholarly service system?
- How human assistive technologies will be able to reduce conflicts in the evolving service system ecology?

In sum, with the help of cognitive mediators or human assistive technologies much more is possible in terms of capabilities and responsibilities (Spohrer, 2016). Human assistive technologies have the potential to help all of us become more humans (Christian, 2011). Rethinking institutions when all individuals have cognitive assistants or human assistive technologies is an opportunity that will shape the service-oriented world of 2055 (Spohrer, 2016).

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