Study trip report:

IFLA WLIC Preconference Satellite Meeting - Robots in Libraries: Challenge or Opportunity? (Technische Universität Wildau, 21-22 August 2019)

The conference Robots in Libraries was organised by IFLA IT section as IFLA WLIC Preconference Satellite Meeting. Its topic – how developing technologies of robotics can get their way to libraries has got into our point of interest for two reasons. Libraries cannot stay much behind commercial institutions in application of technologies, as would not stand their competition and fall out of interest of users. Besides such negative prediction, robots, especially those of humanoid appearance can be used for assistance and attraction to users; especially for gaining young readers, who more and more did not find their way to library doors. The libraries in the Czech Republic have weak experiences in robotics and its possibilities and should keep up with Western Europe and get inspired by Japan.

The conference was hosted by the Technische Hochschule in Wildau located in agglomeration of Berlin. The town has unique industrial architecture of the early 20th century, and also the hosting university is located in renovated buildings of former locomotive factory. The university itself deals with robotics in its library and uses robots, thus specific demonstrations suitably complemented the speeches of the speakers. Approximately 50 participants from Europe, Asia, America and Africa had the opportunity to get acquainted with technical and social research on the use of robots in libraries.

Robots used in libraries around the world can be divided into two categories, informally but fundamentally. The first group replaces human work, most commonly when scanning wireless chips in documents, but also during further manipulation with volumes. The second group is represented by humanoid robots, currently by most widespread model Pepper. Those are intended for supporting readers and users and help them navigate the library or serve as bait, for example for children.

Libraries connected to an academic or research environment have an opportunity to participate on development of robots in the very wide area of interest. Robots intended for interaction with users should be still trained and developed to offer adequate relevant information. Three main fields of these current deficiency and challenge are: natural language processing, at its best in native language; sufficient knowledge base to provide information; and orientation and moving in space and room designed for humans. Robots

for supporting staff work with collections must be still also tested and checked to achieve faster and more accurate results than people, like in scanning volumes in shelves.

At the conference, the first speech after initial invitations was given to Bohyun Kim, associate professor of the University of Rhode Island Libraries (USA), with a general introduction to the extension of robots in the world and views of the future. As a rule, the term robot evokes the idea of a humanoid machine, but robots can take many forms, from a drone, an autonomous vehicle to a therapeutic child's toy. Although the robot has no consciousness, people have a strong tendency to anthropomorphize all objects they come into contact with, including these machines. The prerequisite of the robot as a type of machine is sensors that can sense the signals from the surroundings and triggers that respond to these stimuli. The robots that master the natural language processing then affect as human, autonomous and intelligent. For this reason, people are even more prone to attribute robots to motifs, emotions, and other human traits. The problem here is the degree of autonomy or dependence of the robot on a person, who may not be involved at all or in partly in its activity. It is essential to ensure safety, including immediate shut-downing ("killing") the robot, but also morality. In addition to the technical possibilities, it determines how much the robot gets room for decision-making and control.

Transmission of human qualities, like emotions, to robots could be useful if it helps and supports intent of using the machine. At the same time, this level can be also harmful if it interferes with the robot's functionality. There may also be manipulation by the robot to the human, whether the user is aware of it. Based on these principles, creators of robots also form ideal social rules. Imitation of human behaviour, giving human names to machines represent a potential danger in the use of robots. Similarly, dependence on the creator of the robot in the form of paid upgrades and future programs may also be a potential threat. Such robots are used in libraries for reference and lending services. Readers can see that the robot is not perfect; they can forgive it various weaknesses. The librarian, however, has to deal with the robot's responsibility in making decisions.

The second group of robots that assist librarians was targeted by Ping Fu, professor and director of Library Technology Services, Central Washington University, USA, accompanied by a team of experts from Chinese universities. Machines for revisions and inventorying the collections using RFID technologies are intended to fully automate this activity. This global research team cooperate on the improvement of these machines and increase the effectiveness of inspections and refine the reduction in the error rate. They do not assume physical manipulation of documents by the robot, only their scanning. After a year of experimental experience with an RFID robot in a particular library, only seven workers out of fifty had a real experience with the robot and 32 librarians had no idea about

it. In a user survey, 77 percent of the students have never used this robot as a tool to locate books. Most this last group had no idea of robot possibility, but about a third of it a priori believe that they would find faster than a robot using own skills. About a tenth of the students were discouraged by the complexity of communicating with the robot. 65 percent of users, who used robotic assistance, rated it as a useful aid tool. Other experiments of this research team were focused on robots speed and accuracy. On the task of finding 50 various books at open shelves, which meant about a half an hour of human work, the robot was 30 percent faster on average. When measuring accuracy, a person with an RFID reader achieved a success rate of 96 percent, a robot 97 percent, but it was 4-7 times faster.

Juja Chakarova from Max-Planck Institute in Luxemburg presented a historical excursion to the automation of libraries, as well as results of the application of RFID robots for inventorying in her home library. With the help of a Tory robot (MetraLabs Germany), the library was able to read 35,000 books on an area of 600m^2 within an hour and with accuracy of 99.11%. The robot than travelled 900 meters. Johannes Trabert, representative of Tory robots producer (MetraLabs GmBH) subsequently confirmed their 99 percent accuracy when scanning the RFID chips. He also mentioned robot's features laser and 3D scanning space, which makes him capable to navigate through hard and changing terrain, such as narrow passages or in the presence of moving people. Most of their robots are used by regular shops for inventory, but they are also offered to libraries. J. Charkarova sees the future of using these robots in the possibility of storing books anywhere in shelves without any pre-set order. The robot can continuously monitor the volumes and display the current position of the unit at any time in the catalogue. What can robots be useful in the future? According to a survey among librarians, machines can be most useful for finding lost books (80 percent of answers), inventories and revisions (71%), providing map and library orientation (51%), physically storing and retrieving books (35%), providing advices to readers (22%), but also as a night guard (10%).

Also Stadtbücherei (city library) in Frankfurt am Main uses robots for RFID inventorying, but Elfriede Ludwig focused on robots for children's visitors. The library offers a humanoid robot to kids and organizes a "Meet & Greet with Nao" meeting three times a day to show children how to work with the robot. The event is complemented by occasional discussions, lectures and a workshop of experts. To further develop the robot, the city library has three teams of employees, jointly managed by an education officer. The "library teachers" and school library assistants of the city library design and prepare other events and issues with robots for children, such as "Nao Programming" or "Python Robot Programming". Experience has shown that it is important to have functional teams in the library, but at the same time to build and maintain a broad base of fans from outside, as well as to track and receive financial support.

Robots assisting to librarians are common routine in Singapore. As introduced by Yi Chin Liau, Head of Innovation and Digital Media at the National Library Commission in Sinagapore, they began using automated sorters to classify returned books by category and identify popular titles to be placed on "Just returned" shelves indicating popular works. When the library is closed, the robots autonomously search the books in shelves, provide their current location and mark lost volumes. The National Library of Singapore has already undergone detailed reviews of earlier experiments and prototypes that have verified and improved the initial workflows. This has led to reduction of expenses and simplification of workflows to the aging staff. Librarians can take on other tasks with added value, such as engaging readers and executing library programs.

In the evening we had the opportunity to visit the local university library building, constructed, as well as the entire university in Wildau, from the former factory halls. The humanoid robot Pepper is used there as an assistant for visitors. Its set-up and proper functionality is provided by a team of experts, doctoral students and students from the university. The fundamental deficiency of its functionality is its limited ability to communicate in natural language, especially German. The easiest way to control the robot is still using the touch screen on its chest. The Pepper is able to move on only one floor of the library only and uses graphic marks similar to QR codes mounted on the walls for orientation.

The second day of the conference was opened by Takashi Harada, professor at Doshisha University in Japan. In his homeland, robots are so commonplace that they can no longer be used as a lure to attract readers and potential library visitors. Nevertheless, libraries use them still. A general project in Japan recently introduced 500 humanoid robots (Peppers) to libraries. Most of them are used as guides for visitors and tourists; they do not have much library functions. They should answer FAQs, help with catalogue search, but only when librarians are engaged in other activities. Most often, robots used are for booking seats. Experience shows that these robots may not always be helpful. Some users do not trust them, they did not like their body or arm movements. Robots do not usually have sufficient knowledge base for quality answers. Robots in the form of plush animals and similar toys in children's wards are also being tested. In Japan, they also use "partial" robots that have control over their movements, but users vocally communicate with a person / librarian physically located elsewhere. Prof. Harada also introduced more types of robots for helping librarians in their work. For example, a robot attached to the store-keeper's body that physically assists a person in handling book cases; or a robotic cart with books that automatically follows the librarian with another cart. Instead of using RFID technology, they are gradually introducing a "chameleon code" – a color-crafted analogue of a QR code that is stuck to the back of a book. It is about 50 times cheaper than chips and robots or librarians

capture it using a camera. Libraries in Japan also collect big data on various topics with prospect for to their future use in artificial intelligence, potentially with robots. For example, they develop applications recommending books to readers based on games that can analyse the users' personality.

As the other paper showed, the Czech environment around robots in libraries is now closer to Central Africa than to Japan. Samuel Oladunjoye Odeyemi, PhD student of Information Studies at University of KwaZulu-Natal in Pietermaritzburg, South Africa, showed that robots are gradually of getting to African libraries. So far, they are rather at the theoretical level of preparation and solving questions, infrastructure and human staff. According to social surveys, most people there are afraid of using robots, but they also expect that machines are now able to help with book storing. The main problem in the Central and South Africa is insufficient technological structure, incl. absence of el. power, but also the lack of technical professionals and senior management.

Spanish research team, which was introduced by Gabriel Recatala, associate professor at the Jaume I University, work towards a development and improvement of a robotic arm for removing books from shelves. Also other robots presented at the conference were able to locate books, but taking individual volumes from shelves without a risk of their damage is still in the research phase. The team examines two types of book handles with touch sensors and fine-tuning the removal movement. They are quite successful in this area, the weakest point in their prototypes is OCR scanning of shelf-mark labels on book backs. They also experimented with pictures of backs to identify books. They expect to use this technique in the future, but they face a lack of experts and financial support for research.

A local expert and research team from Tech. University in Wildau presented their project to analyse the use of natural language in communicating with humanoid robots. It should assist in answering questions when there is a queue of students at the counter or a library not closed (robot should be in 24/7 mode). The robot as an assistant is already used in several German university libraries, but communication always takes place via a touchscreen tablet attached to the machine. But the robot is a humanoid, people behave "humanly" with it, which is disrupted by communication through touch tablet only. A possible solution is to use a smart speaker, many of which are available from large producers and can be purchased and implemented. But these are cloud companies (Google, Amazon), where it is not possible to control over what is happening with the data that the robot passes. Another option is the custom solution that the TU Wildau team is working on for German.

Apart from the above products, the small humanoid Nao robot was presented live in the hall during breaks. It is used to support children's reading, when the children first read

the entered text and the robot then puts questions from the text, whether the kids have understood it. However, questions are prepared in advance by humans, and communication with the robot takes place via the touch screen only.

After the first few presentations of the robots, we were truly excited about these clever machines, which are mainly to help people in libraries. However, our euphoria faded during the second day, when we heard about all sorts of problems, like with maintaining a team of expert people, with finding sponsors for the further development. It is definitely not a trodden path where the library would choose a ready-made robotic solution and could use it successfully in the coming years without much effort or with the support of the contractor.

Perhaps except the RFID robots for control and inventory over collections, robotics in libraries is still more in the research phase rather than in routine deployments. More likely, it is now a challenge for experimental teams that can and want to deal with the topic. A librarian who expects a robot to simplify or speed up his work today must be disappointed. We were very pleased by the contrasts of the various libraries in the world, where, such as in Africa, almost everyone is ready for robots, they know almost everything about them, but they do not need them because they are people from Africa and robots do not fit socially into their culture. Another contradiction is, for example, Japan, where today almost no one is noticing robots in their life; they take them as a common part of libraries. The only disappointment for us was the practical demonstration of a robot at the University Library in Wildau, when a native American woman speaking to the Pepper wanted to ask where to find the toilet. After ten minutes of questioning, the robot gave up and she asked the librarian. But otherwise the whole conference was very pleasant, full of empathetic people who always had something to talk about and we have brought many inspirations for planning our library future in the Czech Republic, including planning of our new library building.

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