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ARTYKUŁY I ROZPRAWY

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Next generation electronic catalogs in Polish libraries. Usability and information architecture

Introduction

Since ancient times a library catalogue has been one of the most often applied library services by users. Appearance of online catalogue influenced librarianship like the United States space program on science[1]. The catalogue rules established by Charles A. Cutter have not changed for more than a hundred years. These rules are:

- to enable a person to find a book,
- to show what the library has,
- to assist in the choice of a book[2].

The rules formulated for a card catalogue, written by hand, remain valid for an online catalogue, digitally recorded. Online catalogue aka *Online Public Access Catalogue* (OPAC) is commonly understood as a software or database composed of bibliographical records describing the books and other materials owned by a library or library system, accessible via public terminals[3]. Nowadays, OPAC is no more only information retrieval system consisting of records of books' descriptions, but a kind of system providing access to information resources that a library owns or subscribes. The resources are linked together constituting a net of references between descriptions and full text. This feature is characteristic for a new type of library catalogue, called a next generation catalogue or discovery services. In this article the author presents examples of next-gen OPACs employed in Polish academic libraries; the main aim of the investigation is to compare five examples of new-generation library catalogues implemented in five university libraries in Poland. These are: Virtua CHAMO (the Main Library of the Pedagogical University of Cracow), KOHA (the Cracow University of Technology Library), Primo Exlibris (the Central Library of the Silesian University of Technology), Summon ProQuest (the University Library in

[1] Ch. D. Churchwell, *The Library Academia: An Associate Provost's View*, [in:] E. J. Josey (ed.), *New Dimensions for Academic Library Service*, Metuchen, N.J 1975, p. 28.

[2] Ch. A. Cutter, *Rules for a dictionary catalog, by Charles A. Cutter*, fourth edition, rewritten, 1904, [online] http://digital.library.unt.edu/ark:/67531/metadc1048/, p. 12.

[3] J. M. Reitz, *Dictionary for Library and Information Science*, Westport, Connecticut 2004, p. 501.

Toruń) and Prolib Integro (the Scientific Information Centre and Academic Library in Katowice). The last mentioned search system is a Polish product. There are plenty of modern OPAC examples in libraries all over the world, in Poland, , the information retrieval (IR) systems mentioned above are among the most popular ones. Although Primo, Summon and Prolib are types of discovery systems, they also provide a mode of retrieval of typical library collections. For that reason author uses the name of next-gen catalogue or OPAC to label these IR systems.

Problem statement

First online catalogues in Poland appeared in early 1990's[4] – in the USA in the mid-1970's[5]. After the change of the political system in Poland some Polish universities received financial support to enable digital cataloguing and to provide access to library resources for users. Although Polish libraries commenced to transition to the new form of service later than western European libraries, including format MARC 21, Z39.56 protocol etc., nowadays differences between western and eastern European libraries are not so significant. Evolution of OPAC's in Polish academic libraries is similar to the other countries'.

Before the launch of online catalogues, librarians operated an information retrieval (IR) systems installed on computers. CDS/ISIS (Central Documentation System/Integrated Set of Information Services) set an example of IR system.

We claimed that changes in OPAC interfaces might be divided into three levels: technology, features, users experience. According to attributes mentioned above, it is said that there are three generations of online catalogue development[6]. Below we present each type of OPAC generation based upon users behaviour patterns and design patterns[7]:

1) First-generation OPACs – display records similar to the layout of the catalogue card of book description, applicable in early 90's:
   – technology: focused on librarians requirements, accessed via telnet protocol, connection with library database took place in real time (Fig. 1),
   – features: bibliographic description displayed in card catalogue format, Boolean search, query matching system[8],
   – interaction with catalogue performed by function keys instead of the mouse. Layout was more than modest: white background, black-coloured texts, many unclear labels.
2) Second-generation online catalogue: designed rather for librarians than the users:
   – technology: graphical user interface, part of an integrated library system,

[4] K. Sanetra, I. Gruchała, *Katalog online system VTLS. Podręcznik dla bibliotekarza,* Kraków 1995.

[5] M. Beaulieu, Ch. L. Borgman, *A New Era for OPAC Research: Introduction to Special Topic Issue on Current Research in Online Public Access Systems*, "Journal of the American Society for Information Science" 1996, 47(7), p. 491.

[6] Ch. L. Borgman, *Why Are Online Catalogs Still Hard to Use?*, "Journal of the American Society for Information Science" 1996, 47(7), p. 493–503; Ch. R. Hildreth, *Public Access Catalogs: The User Interface*, Dublin (Ohio) 1982.

[7] P. Morville, J. Callender, *Search Patterns*, Beijing 2010, p. 52–61.

[8] Ch. L. Borgman, *Why Are Online*…, p. 493.

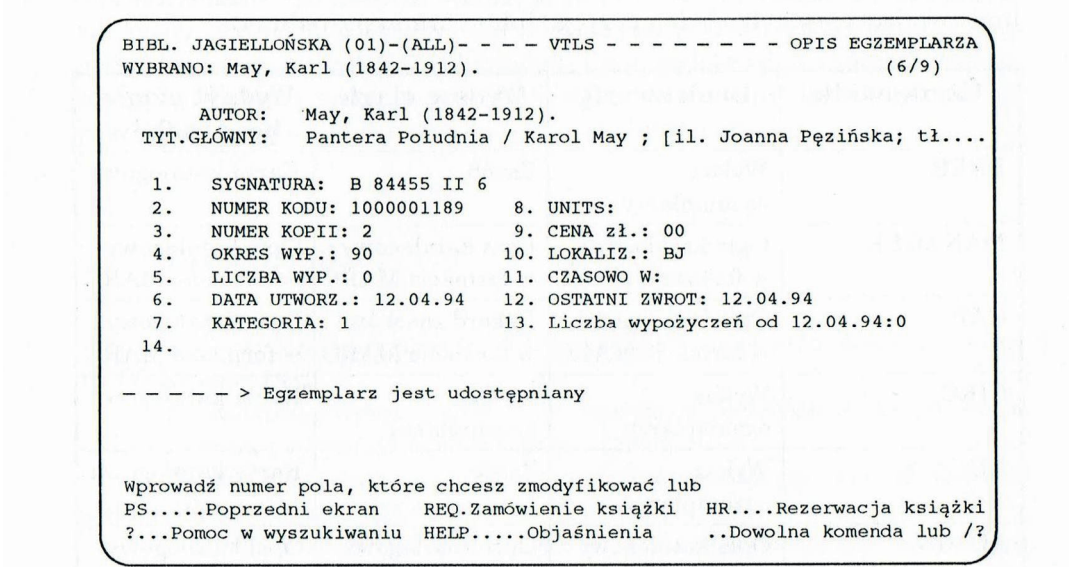

Fig. 1. A screen of Virtua VTLS search system applied in the Jagiellonian Library in Cracow (Poland) in early 90's. An example of a first generation OPAC

Source: Sanetra K., Gruchała I. *Katalog online system VTLS. Podręcznik dla bibliotekarza*, Kraków 1995, p. 117

- features: new modes of displaying format, best-match search pattern,
- user experience: designed for highly skilled person in searching information domain, it also required highly detailed information, i.e. finding known books[9].

3) Third-generation online catalogue (new- or next-generation catalogue – NGC):

technology: focused on user's needs, metasearch engine (federated search mechanism), linked data from various resources,

- features: provide narrowing search results mode, i.e. faceted navigation (filters),
- user experience: support discovery (exploration) rather than search, refining results pages selecting the appropriate attribute, i.e. publication date, subject, type of media etc.

The third-generation OPACs are also named the *discovery systems* or *discovery and delivery systems*[10]. However, there are several differences between them, i.e. the scope: NGCs are limited in most cases to library book collections while discovery systems such as Primo, Summon or Prolib Integro provide options of extending retrieval span for multiple databases and digital libraries resources. They are, therefore, called metasearch engines[11].

[9] Ch. L. Borgman, *Why Are Online*..., p. 494.

[10] T. Sadeh, From search to discovery. Paper presented at: IFLA WLIC 2013 – Singapore – Future Libraries: Infinite Possibilities in Session 98 – Knowledge Management with Academic and Research Libraries 2013, [online] http://library.ifla.org/id/eprint/104.

[11] B. Macan, G. V. Fernández, J. Stojanovski, *Open source solutions for libraries*..., p. 140.

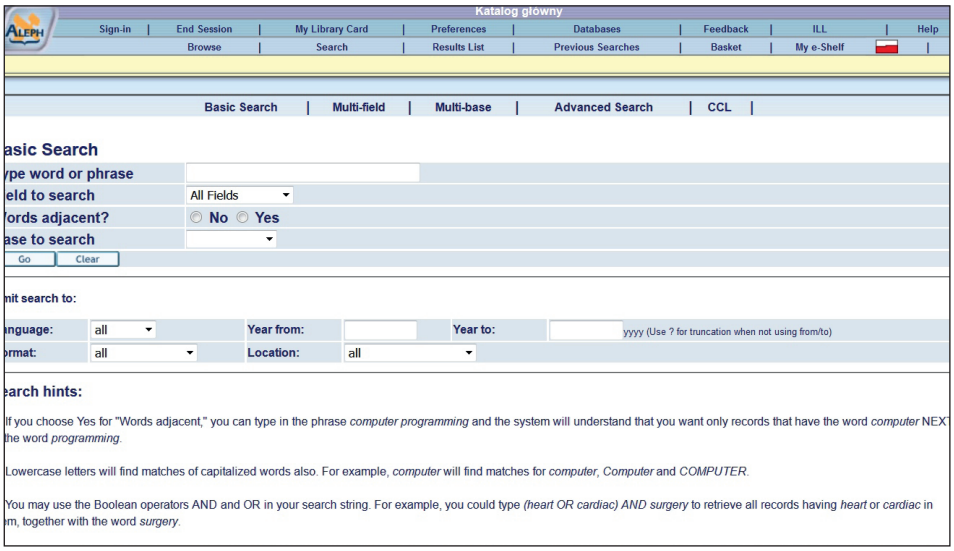

Fig. 2. Screen of Aleph OPAC interface. A second-generation OPAC

Literature review

The term "next-generation catalogue" was introduced in 2007[12] while launching the OPAC library system at North Carolina State University. A large number of terms that are synonyms to OPAC appeared in the state-of-the-art dealing with OPAC in Polish libraries. These are: automated catalogue, computer catalogue and online catalogue[13]. Next- or new-generation OPAC was largely investigated especially in English language publications from a different points of view[14]: user requirements, perceptions and usability[15], as well as comparison between different OPACs systems[16]. Large OPAC user research has been led since 1980's[17].

Discovery as a searching method applied by OPAC users was also studied[18].

[12] T. Sadeh, *From search to discovery*..., p. 2.

[13] S. Kurek-Kokocińska, *Z zagadnień terminologicznych nauki o informacji. Potrzeba języka słów kluczowych*, "Zagadnienia Informacji Naukowej" 1998, no. 2, p. 82.

[14] H. M. Osborne, A. Cox, *An investigation into the perceptions of academic librarians and students towards next-generation OPACs and their features*, "Program: electronic library and information systems" 2015, vol. 49, no. 1, p. 23–45; M. A. Hofmann, S. Q. Yang, *"Discovering" what's changed: a revisit of the OPACs of 260 academic libraries,* "Library Hi Tech" 2012, vol. 30, no. 2, p. 253–274.

[15] J. Emanuel, *Usability of the VuFind Next-Generation Online Catalog*, "Information Technology and Libraries" 2011, March, p. 44–52.

[16] T. Merun, M. Zůmer, *New generation of catalogues for the new generation of users. A comparison of six library catalogues*, "Program: electronic library and information systems" 2008, vol. 42, no. 3, p. 243–261; B. Macan, G. V. Fernández, J. Stojanovski, *Open source solutions for libraries*..., 2013; J. C. Fagan, M. Mandernach, C. S. Nelson, J. R. Paulo, G. Saunders, *Usability Test Results for a Discovery Tool in an Academic Library*, "Information Technology & Libraries" 2012, 31(1), p. 83–112.

[17] Ch. L. Borgman, *Why Are Online*...; Ch.R. Hildreth, *Public Access Catalogs: The User*..., 1982.

[18] Y. Wang, J. Mi, *Searchability and Discoverability of Library Resources: Federated Search and Beyond*, "College & Undergraduate Libraries" 2012, vol. 19, p. 229–245.

Polish researchers also investigated the OPAC topic, predominantly from the information technology point of view, i.e. as a guide for librarians[19] or an overview of problems of library system implementtion[20]. Online catalogues of libraries in Poland were examined infrequently[21].

Problem of discovery as information behaviour was also discussed in literature[22]. In fact, discovery of information resources is one of the characteristic features dealing with next-gen OPACs. Changes after OPAC interfaces transformation into next-gen catalogues included new tools supporting discovery process of search[23]. Some of these tools were discussed later on in this paper.

Problems, methods and research questions

The paper provides a comparative analysis of the different next-gen OPACs. The main aim of the study was to find out whether OPAC differs from discovery systems in information architecture layer.

Evolution of online catalogues is not only a question of technology, but furthermore a matter of user experience. Google – the most popular search engine – has changed the approach to information searching area, similarly to Web 2.0. Information searching process on Google user experience, however, differs from information searching in NGC with discovery tools. One reason for this fact is development of information technology in designing of search engines. Predominantly, before OPAC searching was introduced in a library, a catalogue had been librarian's domain. He or she was an intermediary between users and information system. In the time of pre-OPAC librarian was probably the only profession skilled enough to manage to find information in usable less than expected, complex interfaces of information retrieval systems (Fig. 3).

Introduction of NGC had impact on user search methods, as it was mentioned earlier. Users started to explore resources rather than seek a published item. What are the differences between *search* and *discovery* in context of information seeking model? Firstly, searching is connected with more targeted and specific information need[24], secondly, whereas a user searches for information, presumably he or she attempts to locate a known item[25] (Fig. 4). Searching is also associated with a search

[19] K. Sanetra, I. Gruchała, *Katalog online system*…

[20] E. Dobrzyńska-Lankosz, *The Krakow Project. Problems of Management*, [in:] A. Lass, R. E. Quandt (eds.), *Library Automation in Transitional Societies. Lessons from Eastern Europe*, New York 2000, p. 360–373.

[21] I. Swoboda, *OPAC WWW wizytówka biblioteki. Ocena jakości katalogów komputerowych małych i średnich bibliotek w Polsce*, "Przegląd Biblioteczny" 2009, vol. 1, p. 16–40.

[22] T. Sadeh, *From search to discovery*…

[23] J. C. Fagan, M. Mandernach, C. S. Nelson, J. R. Paulo, G. Saunders, *Usability Test Results for a Discovery Tool in an Academic Library*, "Information Technology & Libraries" 2012, 31(1), p. 83.

[24] T. Russel-Rose, T. Tate, *Designing the search experience. The Information Architecture of Discovery*, Amsterdam 2013, p. 73.

[25] T. Fethers, Ch. Gaul, J. A. Marshall, B. Tiffen, *From Search to Discovery in our Future Library*, University of Technology, Sydney 2013, [online] http://www.lib.uts.edu.au/blog/university-librarian/2013/04/search-to-discovery-our-future-library.

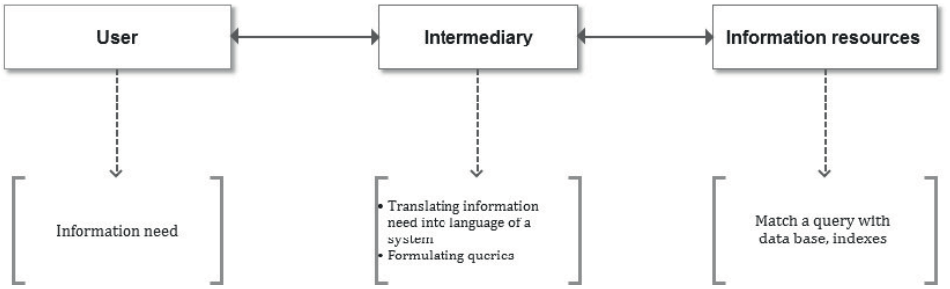

Fig. 3. A model of information searching in catalogue in pre-OPAC era

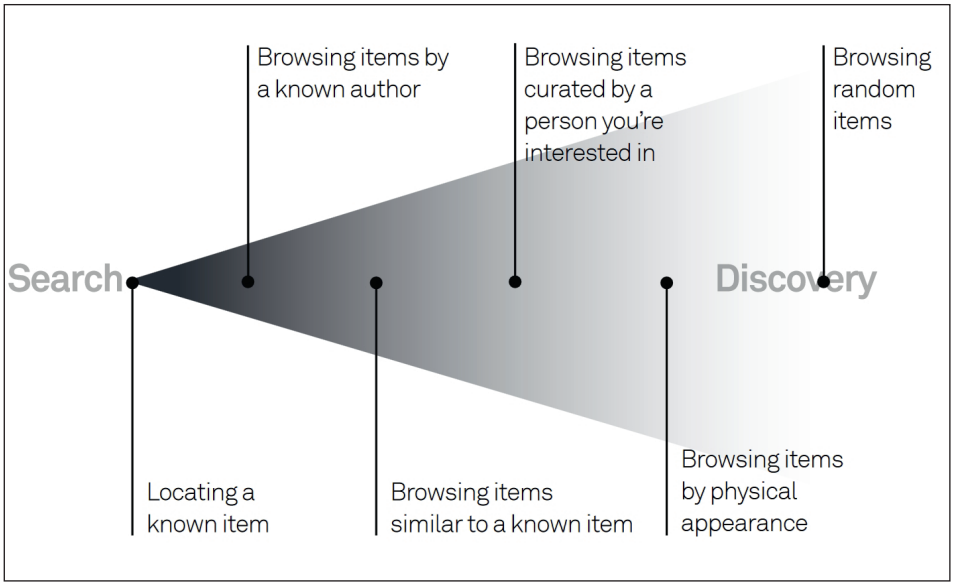

Fig. 4. Differences between search and discovery. Tribute to: Fethers et al., http://www.lib.uts.edu.au/sites/default/files/documents/THETA%20Presentation%202013%20notes.pdf
Source: Fethers T., Gaul Ch., Marshall J.-A., Tiffen B., *From Search to Discovery*...,

engine applied using keywords. The research findings[26] suggested that this strategy generally satisfied users provided that they know author's name or title. An example: "I need the latest Umberto Eco's novel".

Discovery seeking strategy is more open, unclear and imprecise[27]. This method of seeking is associated with browsing and navigation. The study on the next-gen OPAC was based on the ten design patterns listed by specialists in a survey led by Peter Morville and Jeffery Callender[28]. The patterns in this context meant the

[26] *Online Catalogs: What Users and Librarians Want. An OCLC Report*, Dublin (Ohio) 2009, [online] http://www.oclc.org/content/dam/oclc/reports/onlinecatalogs/fullreport.pdf, p. 13–14.
[27] T. Fethers, Ch. Gaul, J. A. Marshall, B. Tiffen, *From Search to Discovery*...
[28] P. Morville, J. Callender, *Search Patterns*, Beijing 2010, p. 81–82.

Fig. 5. Autocomplete module in the Virtua CHAMO search interface (Main Library of Pedagogical University of Cracow)

best solutions for common problems emerging throughout information retrieval system designing. These are: autocomplete, best first, federated search, faceted navigation, advanced search, personalisation, pagination, structured results, actionable discovery.

Autocomplete is a mechanism of giving suggestions by IR system that appear automatically during entering first letters of a search term. This pattern was introduced by Yahoo! (Fig. 5).

Best first displays the essential information among the top ten search outcomes on search engine result page – very significant for making information search simple, fast and relevant[29]. Hits (found items) are ordered by relevance, popularity, date, format, personalisation, diversity[30].

Federated search, also called metasearch, parallel search and broadcast search; the term means distributing a single search query to multiple sources of information and aggregating the results into a single point of access, usually displayed in a common format[31]. This approach enables large number of databases, catalogues, collections and others e-resources to be searched at the same time (Fig. 6).

Faceted navigation, also called guided navigation – facets are independent dimensions enabling to classify an object[32]. Faceted search is a mechanism of narrowing search results using filters (facets). The filters support user's decision to eliminate the unnecessary results and are based upon metadata fields and the category which items have been qualified to.

[29] Ibidem, p. 87.
[30] Ibidem, p. 88.
[31] Y. Wang, J. Mi, *Searchability and Discoverability of Library Resources: Federated Search and Beyond*, "College & Undergraduate Libraries" 2012, vol. 19, p. 229.
[32] T. Russel-Rose, T. Tate, *Designing the search*..., p. 178.

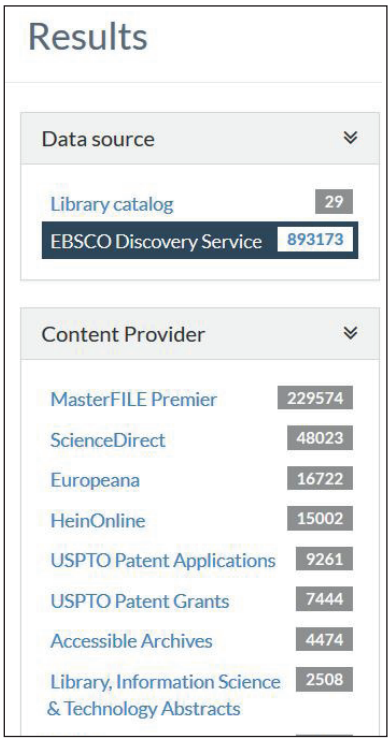

Fig. 6. The part of Prolib Integro screen, displaying e-resources including the federated search

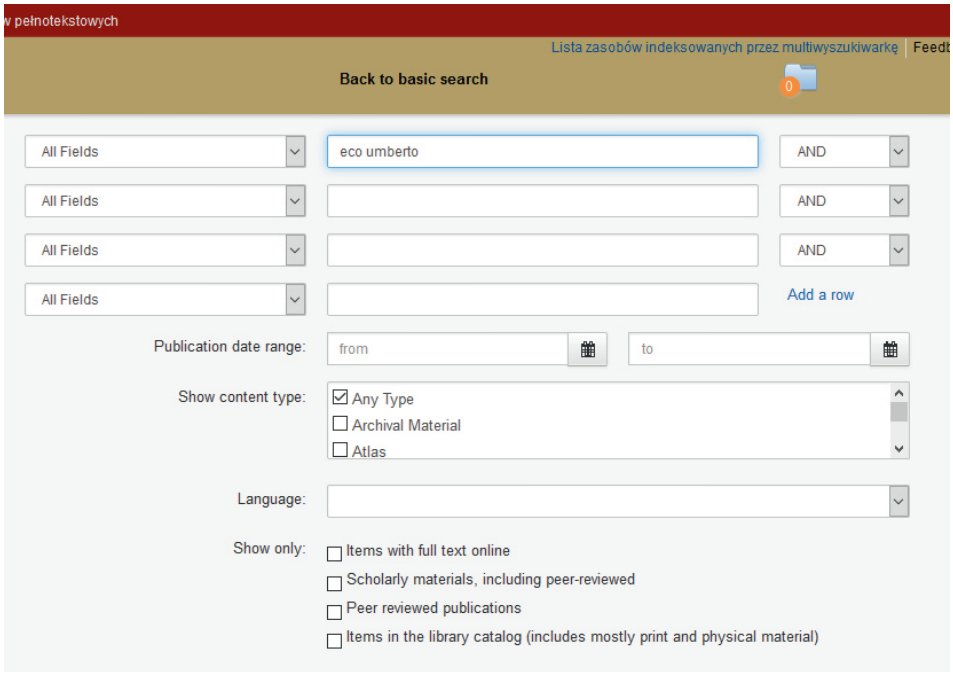

Fig. 7. Advanced search form (Summon ProQuest). University Library in Toruń

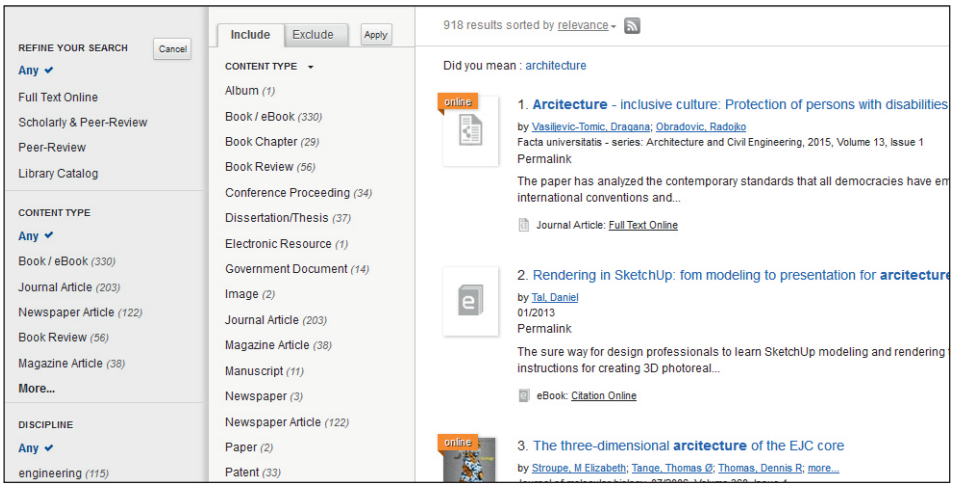

Fig. 8. Structured results in Summon ProQuest search result page. University Library in Toruń

Advanced search is an additional search interface which includes more than one search field. The number of the fields is equal or less than the indexed fields helping users to find information. The main retrieval mechanism in advanced search implements Boolean operators: AND, OR, NOT. Users rather rarely apply this pattern because of its difficulty for novice users[33] (Fig. 7).

Personalisation, or customisation – model that lets users explicitly modify settings, i.e. change colour, layout, adapting them to user behaviour and preferences (repeated keywords), localisation. This pattern is a sign of the Web 2.0 trend, that focused on user participation in content management (publishing, reviewing, evaluating etc.).

Pagination – search results in a huge number of hits are divided into pages, user navigates through them by activating special links – number of pages displaying below or on the top of the result lists.

Structured results – a pattern of search results divided according to format of the found items, i.e. type of media: books, e-books, journals, images (Fig. 8). Actionable discovery, provides features (options) that will allow users to take an action after receiving search results, i.e. moving to online content by clicking to directional links[34], choosing "add to basket" (borrow) after finding the desired product (Fig. 9).

Unified discovery helps users proceed between modes of browsing, searching, asking, exploring. This pattern provides a framework in which the methods of searching are integrated (pattern of patterns)[35] (Fig. 10).

The design methods mentioned above were applied to investigate how the extended NGCs are different from 2nd generation OPACs. We added another functionality to the studied features – mobile version of interface, as a result of so-called responsive web design (RWD). Mobile interfaces trend appeared in 2008 after the introduction of the iPhone. In 2014 in Poland, for the first time the number of mobile Internet devices (smartphones, tablets) users exceeded the number of desktop and

[33] P. Morville, J. Callender, *Search Patterns*..., p. 102.
[34] *Online Catalogs*..., p. 11.
[35] P. Morville, J. Callender, *Search Patterns*..., p. 125.

Fig. 9. List of hyperlinks leads to actions (right column). Library of the Cracow Uniwersity of Technology

Fig. 10. Virtua CHAMO interface allows users to flow from searching to refining and narrowing (1) or navigating (2) to the destined record. The Main Library of Pedagogical University of Cracow

laptop users[36]. Responsive interface is an interface adapting to any screen size; for that reason optimal and usable web sites are designed with mobile-first approach. Contemporary users demand content to be flexible enough to fit into any mobile device screen.

[36] *Mobile online w Polsce 2015. Perspektywy rozwojowe. Raport*. (n.d.), Warszawa mobile_2015.pdf , p. 19.

Findings

Five OPAC and discovery systems were analysed based on the features described in Chapter 4. Table 1 consists of the features and marks (points) – 1 point means that the appropriate function was available, 0 points that it was not available. Summon ProQuest, Primo Exlibris, KOHA and Prolib Integro obtained the highest scores, 10 points, whereas the Virtua CHAMO gained only 9 points.

Tab. 1. Comparison of interface elements in five next-generation OPACs. (1 – function available, 0 – function not available)

Feature	Summon ProQuest	Primo Exlibris	Virtua CHAMO	KOHA	PROLIB Integro
Autocomplete	1	0	1	1	0
Best first	1	1	1	1	1
Federated search	1	1	0	0	1
Faceted navigation	1	1	1	1	1
Advanced search	1	1	1	1	1
Personalisation	1	1	1	1	1
Pagination	0	1	1	1	1
Structured results	1	1	1	1	1
Actionable discovery	1	1	1	1	1
Unified discovery	1	1	1	1	1
RWD	1	1	0	1	1
Sum	10	10	9	10	10

Discussion

Autocomplete was one of the rarely occurring design patterns in analysed NGC interfaces; the lack of this function was observed in Primo Exlibris and Prolib Integro IR systems. The best first pattern according to analysis was noticed in all interfaces, but there were differences in number of options provided for users, i.e. Summon ProQuest allows to sort search hits based only on date and relevance, while the KOHA interface had five main categories to sort: *Popularity*, *Author*, *Call number*, *Dates* and *Title*. Inside each category a user was able to choose contextual subcategory, i.e. *Author*, then *A-Z* or *Z-A* or *Popularity*, then *most to least* or *least to most*. In the example of Virtua CHAMO an additional sorting option: *Recently added items first* was provided. Third of examined patterns was federated search. Two of five NGCs: Virtua CHAMO and KOHA did not contain that search option. Both Virtua and KOHA were online catalogues which do not encompass retrieval in other databases except for library collections. Another design pattern was faceted navigation – one of the most NGC's significant attribute. Each of investigated interfaces provided facets to narrow search results, however, hyperlinks of the filters in Primo and KOHA did not contain numbers of records (usually displayed in brackets) – which is a common

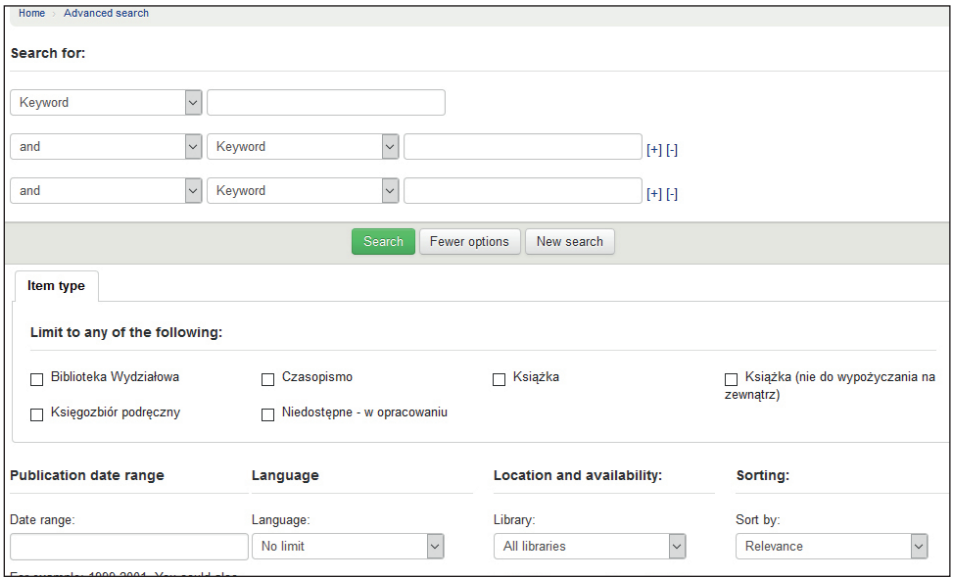

Fig. 11. Advanced search form in KOHA catalogue. Library of the Cracow University of Technology

convention for navigation menus helping users to make a better decision[37]. The consequence of this lack of information about quantity of resources relevant to facets might lead users to uncertainty of the obtained results. Each of investigated NGCs provides facets with a single-select mechanism of selection showing dynamically only those facets that are related to results on the screen. The next examined pattern – advanced search – is a common query formulation interface applied in OPACs since their first-generation had appeared; we can describe it as a traditional module in online catalogues. All examined NGCs provided these searching tools. In Virtua CHAMO case two variants of such query formulation forms existed: *Heading search* and *Advanced search.* In KOHA example advanced search form consists of three types of interfaces: common search boxes to enter queries, checkboxes to narrow results by clicking on boxes and drop-down menu with more detailed search requirements, i.e. date, language, type of library etc. (Fig. 11).

Personalisation is a mode that was implemented in all five analysed OPACs. Unfortunately, most of them were accessible by login into account. Prolib Integro offered users a setting to change the contrast of display screens. Another customisation features included: reminder of previous entered search terms (Primo, KOHA, Virtua), search history (KOHA, Virtua, Prolib), language change (all OPACS) (Fig. 12).

Four of five analysed NGCs (except Summon) maintain a pagination mechanism that divided search results into pages (i.e. 10, 20, 30, 40 records per page – Virtua). All of the interfaces mentioned in this paper maintained at least few options of clustering search results. Outcomes obtained from search engine might be grouped according to: content type (books, albums, images, music), literary form (Virtua), item type (KOHA, Prolib), type of loans (KOHA). After finding a relevant item OPAC should facilitate further exploration related to user's task. The most frequent actions

[37] T. Russel-Rose, T. Tate, *Designing the search*..., p. 178.

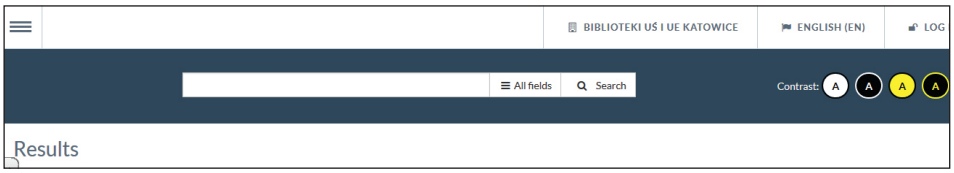

Fig. 12. A Prolib search form with button activating a colour and contrast change

undertaken by OPAC's users are: access to online content (full texts) – offered by all investigated NGCs, evaluative information (summaries, tags, reviews) (Primo, KOHA, Virtua), item availability information[38] – i.e. whether a book is ready (or not) to be borrowed. In addition to those listed above, other functions have been noticed for actionable discovery. These were: sharing with social media (KOHA), saving records (Virtua, KOHA), preparing citation, making book reservation and sending information about records via e-mail (Summon). All five NGCs assisted users with the flow from searching, through browsing to discovery. It meant that starting from query formulation he or she was able – by using OPAC – to explore results, narrow, select or group them according to information needs and tasks. Last research subject responsivity of next-generation catalogues interfaces (RWD) has been analysed based on the layouts test on small screen (334 x 484 px). Only Virtua CHAMO interface was not adaptable to mobile devices. Although this OPAC appeared to be one of truly next-gen ones, in this case it turned out to be still on second-generation stage.

Conclusions

The study was limited to five next-generation OPACs, but of course there are many more NGCs implemented in libraries in Poland (SOWA, Horizon, Aleph, Patron etc.). The research has been carried from an information architecture's point of view. The complementary approach could be conducted from librarian's position. Although, according to findings, none of the investigated OPACs offered full set of design patterns, some of the features have been implemented in all examples. These are: best first mechanism, faceted navigation, advanced search forms, customisation of settings, clustering results and module of taking further actions based on search results.

An important deficiency that has been noticed was a lack of federated search patterns that according to research are preferred by OPACs users[39]. In conclusion, the study presented in this article showed that differences between OPACs (KOHA, Virtua CHAMO) and discovery systems (Primo, Summon and Prolib) were not so significant. Only one crucial feature sets two types of IR systems apart, that is a federated search.

For future research it would be worth mentioning that studies on OPAC in Polish environment should be continued and expanded for additional patterns and groups of users. We did not mention the *Did you mean?* option that supports correction of errors while entering keywords. Further analysis might include other OPAC and integrated library systems as well.

[38] *Online Catalogs*..., p. 11–14.
[39] Y. Wang, J. Mi, *Searchability and Discoverability*..., p. 229–230.

Users want the modern library catalogues searching to be as easy as using the Google. We argue that it will be possible on condition that more researchers will conduct study on usability and search strategies of online catalogues users. A question for existence of libraries in Internet era became unconfirmed, however, there is much to be done in the research on designing and human interaction with information retrieval systems in Poland.

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Abstract

The latest generation of electronic directories, called the third or next, was founded, among others, as a result of use of principles of usability in the design of websites. To the characteristics of the directories of third generation in technological terms belong: optimization to meet the needs of users, application of metasearch, interconnection of data into one system. Among the features offered by the new OPAC we have: auto-complete, federated search, faceted search, and personalization. In Poland, among the systems that support new functionalities, we can mention: Virtua CHAMO (Main Library of the Pedagogical University of Cracow), KOHA (Main Library of Cracow University of Technology), Primo Exlibris (Main Library of Silesian University of Technology), Summon ProQuest (University Library of Nicolaus Copernicus University in Toruń) and Prolib Integro (Katowice CINiBA). The aim of the article was to compare these systems in the field of applications of modern mechanisms (patterns) of designing the search systems. None of the analyzed retrieval systems contained all available functionalities to facilitate finding information. The least number of functionalities was found in Virtua CHAMO, the most – in the systems of the type of "discovery" (Primo, Summon and Prolib).

Key words: electronic catalog of new generation, information architecture, usability, academic libraries in Poland

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