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EXTENDING THE LIVE CHAT REFERENCE SERVICE AT THE UNIVERSITY OF TURIN - A CASE STUDY

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Abstract

This paper aims at describing the feasibility study and verification of the minimum requirements which are needed to extend to the Library of Psychology the online reference support that the University of Turin Digital Library Department managed by Franco Bungaro offers its users. The methodology adopted for this task derives from that developed in a previous project which aimed at improving the communication with library users. This goal was accomplished by means of the automatic analysis of the exchanges between the Library Service patrons and the librarians who provided live chat support from 2014 to 2016. The approach that has been adopted to carry out our reference-related projects derives from a particular Academic research field called “digital humanities”, which represents the intersection between information technologies and humanity studies. Therefore, in order to produce feasible data which could be used to carry out quantitative and qualitative analysis, an automatic processing algorithm was developed. Both the methodology adopted and the results obtained substantiate the need to extend our online reference service to specific libraries to improve the quality of our work.

Keywords

Virtual reference service, chat exchange, library of psychology, READ Scale, natural language processing, computer-mediated communication

Methodological premises

The project presented in this paper deals with operative and organizational aspects of the computer-mediated communication for library reference. Using network and electronic technology for reference purposes started in the United States academic library environment around thirty years ago. On this matter B. Sloan (2006) published “Twenty years of virtual reference”. In his study the author considered a milestone the paper of Howard and Jankowski (1986) on the usage of email technology as a reference instrument at the Health Sciences Center:

[...] what I believe may be the first journal article devoted to virtual reference.

A significant change happened in 1990s, when different academic institutions decided to adopt live chat to provide virtual reference to patrons. This new technology provided two distinct communication typology for virtual (or digital) reference service. Taher explained such difference by analyzing the reference interview with patrons:

The reference interview in cyberspace can be defined as a real-time or non-real-time, web-based-text, and sometimes voice and/or video-24 communication between the reference interviewer and interviewee. Real-time reference is synchronous interaction, or an instant transaction between the interviewer and the interviewee.

Non-real-time reference is a delayed interaction, which is a follow-up of a reference inquiry received by e-mail or web forms. (Taher, 2002)

The online synchronous reference put librarians in front of the challenge to conduct effective interviews without establishing face-to-face interaction with patrons (Fagan & Desai, 2002). For this reason, new communication and problem-solving strategies were adopted. In early 2000s the new real-time digital reference support opportunities started being explored. In 2002 the IFLA (International Federation of Library Associations and Institutions) published the first edition of the digital reference guidelines (IFLA, 2002). Marsteller and Mizzy analyzed the first year of chat reference exchanges at Carnegie Mellon University. In particular, user requests and operator responses were taken into account. From this work the problem of the poorness of analysis instruments emerged. Literature offered too few studies and the results obtained did not follow standard methodologies:

As indicated in the literary review, the authors explored using schema from existing reference interaction research, but they found no standardization. The authors therefore decided to craft their own schema, or set of categories, that attempted to capture the nuances of digital reference. (Marsteller & Mizzy, 2003)

Consequently, the two authors designed a logical scheme which helped categorize the different question and answer exchanges. After doing so, results were inserted into a spreadsheet and statistically processed. In the same year, Gerlich and Berard (2007) started testing their READ (Reference Effort Assessment Data) Scale at the Carnegie Mellon University to define the skills that librarians need to possess in accordance with the patron requests.

Lankes (2004) described the skills United States librarians should have to manage the new reference technology. Hirko and Ross (2004) write a handbook for virtual reference learners in which exercises, effective communication examples and instruments to improve the usage of hardware, software and terminology facilities are provided, while the Reference User and Service Association prints the *Guidelines for implementing and maintaining virtual reference services* (RUSA, 2008).

For many years several researches on real-time chat reference focused their attention on the key competencies librarians had to develop to better understand the patron needs. Any project designed its own data analysis procedure. However, such procedures were difficult to reproduce and standardize. Usually all the exchanges underwent a first manual tagging; the results of this operation were then processed by a statistic algorithm. This approach was adopted by a number of project which aimed at improving the academic reference service (Morais & Sampson, 2010) or the fruition of the library websites (Fan & Welch, 2016).

In Europe the chat-based virtual reference systems were adopted later. Bakker (2002) presented a Dutch project to implement at Royal Library a virtual reference service based on *QuestionPoint*¹ from OCLC. The next year, Rösch (2003) mentioned in his paper all the academic libraries which started a virtual reference service in Germany. As for France, Claire Nguyen (2006) clearly states that French academic libraries suffered a significant delay:

Mais les bibliothèques universitaires accusent aussi un retard par rapport à leurs homologues anglo-saxonnes et nordiques notamment.

In 2009 the University of Seville library (Spain) implemented a reference service based on an instant messaging platform named LibraryH3lp (Fernández-Villavicencio, Gómez, & Fernández, 2009). The same software was adopted the next year in England in a pilot project at Cardiff University (Haerkoenen, Blackmore, & Beadle, 2012).

Opposite to the high number of researches performed in the United States, very few virtual reference service monitoring projects were carried out in Europe. One of the most relevant was described in 2014 (González-Fernández-Villavicencio, Cánovas-Álvarez, & Arahaj-Junco, 2014) in a paper which analyzed the effectiveness of the online reference service provided by the University of Seville library in accordance with the READ Scale. As regards Italy, few live chat reference services have been activated by academic institutions so far. However, it is possible to state with certainty that the University of Parma and the University of Turin are public entities which provide synchronous reference support to their patrons.

¹ <http://www.questionpoint.org/>

The virtual reference service at the University of Turin

The Academic Library System of the University of Turin started in 2014 a new bibliographic research service named "TUTTO"². This service, based on the Ex Libris Discovery Tool named "Primo", allows an integrated research of all the academic library resources via a single input box. TUTTO was also integrated with a live chat software from SnapEngage³ in order to provide the academic library patrons with an easy and convenient way to get online support directly from qualified librarians.

Although at first the live chat service aimed at helping patrons use TUTTO, after short time it became the main online reference service for all the University of Turin library facilities. Support was requested not only for using the discovery tool, but also for solving other issues like the way to gain off-campus access to the academic library digital resources, how to carry out bibliographic researches, which services and facilities were available in different University of Turin libraries, etc. In few months, service-related questions increased so much that another SnapEngage chat widget was added on the Academic Library System homepage⁴. This choice was strategic because of the role the Academic Library System web page has covered within the UniTo web portal. Only that page provides patrons with all the links to the different University of Turin's library web sites and bibliographic resources.

Since 2014 all requests that patrons made to the live chat reference operators were saved in log files. In 2017 the said files were processed and analyzed to better understand the type of information they contained. The results of this research provided useful data to help effectively improve the University of Turin library services. Therefore, besides the work described in this paper, a project for semi-automatically producing a FAQ list was also previously carried out (Muzzupapa, Tomatis, & Bungaro, 2017).

Both projects were realized by adopting a multidisciplinary approach derived from an unusual, but fruitful collaboration between a reference librarian and a computational linguist skilled in natural language processing. This winning synergy was fostered by both Mrs. Viviana Mandrile and Mr. Franco Bungaro, who are the people in charge of managing the University of Turin's "Polo di Scienze della Natura" and the Academic Library Services, respectively. The "Polo di Scienze della Natura" (Nature Science) is one of the six library divisions which were created in early 2017 with the aim of providing a common management policy to a number of single entities. By this new organization, all the 30 University of Turin libraries were grouped into six different administrative divisions (called "poli") in accordance with the academic subject dealt. Divisions are: Agriculture&Veterinary, "Campus Luigi Einaudi" (which deals with subjects like: law, human sciences, statistics, sociology), Economy&Management, Humanistic Studies, Medicine, Nature Sciences. The libraries which are managed by Mrs. Mandrile deal with the following subjects: human movement, chemistry, earth science, information science, physics, mathematics, pharmacy, biology, psychology.

Data analysis

During the first three years of activity, the live chat service registered a number of reference requests which were addressed, amongst others, to the library of Psychology (named "Kiesow"). Therefore, in order to evaluate the feasibility of activating a new chat widget on the Kiesow library website⁵, Mrs. Mandrile asked us to perform a quantitative and qualitative analysis of the pertinent chat exchanges. In order to face this request, all 2474 live chat conversations which were saved in different files in a time span of three years - from 2014 to 2016 - were merged in a unique text file and subsequently tokenized (see "text processing methodology").

The result of this processing represented the starting point to carry out our research activity, which was divided into a number of different, subsequent steps. The first processing we carried out aimed at narrowing down the total amount of chat exchanges to those which were tied to the scientific library group only. This was made by performing a keyword-driven automatic selection of chat exchanges. However, differently from our previous FAQ project in which we used keywords related to the library services the University of Turin provides its patrons (e.g. "biblioteca" (library), "accesso" (access), "prestito" (loan), "proroga" (renewal), "articolo" (article)), in the current project all keywords were selected by adopting criteria which were

² <http://www.tutto.unito.it>

³ <https://snapengage.com/>

⁴ <https://www.sba.unito.it>

⁵ <https://www.bibliopsicologia.unito.it/it>

specifically focused on the different academic subjects the library patron's questions were addressed to. In particular, since our project aimed at understanding the live chat question distribution within the whole "Polo delle Biblioteche Scientifiche" by taking into account both semantic and formal text elements, two different sets of keywords were used. The formal pattern was represented by keywords which addressed a specific library from an institutional point of view. Therefore, library names like "Peano" (Library of Mathematics), "SUISM" (Library of Human Movement), "Ponzo" (Library of Chemistry) and "Kiesow" (Library of Psychology) or the names of subject-specific resources (e.g. "psycARTICLES" or "PsycINFO") were used. Differently from using institutional names, the keywords selected with semantic criteria were strictly tied to the subject areas of the libraries we took into account. Terms like "matematica", "fisica", "chimica", "farmacia" ("maths", "physics", "chemistry", "pharmacy") represented proper solutions. Besides, reference requests by Kiesow patrons asking for bibliographic research support could be automatically selected by integrating the generic term "psychology" with subject specific terminology like: "Disturbo", "Apprendimento", "Comportamento" or "Disorder". Despite the mentioned criteria, it is important to clarify that the results obtained with the automatic procedure could not be considered completely satisfactory. Often patron requests were difficult to categorize. Resources like "PubMed" or "Science Direct" could be accessed by patrons of different academic departments. Therefore, in case specific, characterizing terminology was lacking, there was no way to understand how the ambiguous chat exchange should be properly classified.

Visitor: 07:22:49: ciao, avrei bisogno di trovare gli articoli pub med

Maria Vittoria: 07:22:58: sì

Visitor: 07:23:00: dove trovo il link a pub med?

Maria Vittoria: 07:23:05: aspetta

Visitor: 07:23:11: grazie

Maria Vittoria: 07:23:12: ti invio il link

Visitor: 07:23:28: tks

Maria Vittoria: 07:23:36: sei sul sito del sistema bibliotecario?

Visitor: 07:23:45: sì

Maria Vittoria: 07:23:55: guarda a destra

Maria Vittoria: 07:24:00: su accesso rapido

Maria Vittoria: 07:24:04: c'è un link

Maria Vittoria: 07:24:12: banche dati di ateneo

Maria Vittoria: 07:24:15: clicca lì

Maria Vittoria: 07:24:38: e si apre una pagina con un elenco di banche dati

Maria Vittoria: 07:24:45: c'è anche il link a pubmed

Visitor: 07:24:56: grazie mille

Visitor: 07:24:59: buon lavoro

Visitor: 07:25:02: gentilissima

Maria Vittoria: 07:25:02: figurati

Maria Vittoria: 07:25:08: anche a te

Maria Vittoria: 07:25:08: ciao

Until now we have described the semi-automatic methodology we adopted to select and count the live chat exchanges from the entire log file. However, in order to answer the question which gave birth to the present project (i.e. "is the amount of requests which are addressed to the University of Turin's Psychology Library so high that a new chat instance should be implemented into the Kiesow library website?"), a different methodology had to be adopted. This next project step required to analyze thoroughly, from a qualitative point of view, the text contents we previously selected. For such reason we moved from a semi-automatic processing to a purely manual approach. The choice to perform a qualitative in-depth analysis of our data was due to the fact that the reference support may take a different degree of detail. Therefore, to uniformly categorize the type of responses our patrons received, the READ Scale was adopted. In order to do this, we examined every single reference exchange addressed to the Kiesow library to understand how the original patron request changed and evolved during the entire interview. This analysis aimed at dividing the questions which could be better answered

by a subject librarian working at Kiesow Library from those which could be managed by a generic reference librarian⁶.

The following is the list of criteria we adopted to select the most complex request in accordance with the READ Scale:

1) Is the patron bibliographic request strictly tied to psychology subjects?

Example: "Visitor: 11:22:58: ciao cara, sono una studentessa di psicologia clinica.. devo fare una tesi sul filicidio altruistico con madri che hanno disturbo paranoide. sapresti consigliarmi qualche sito dove potrei trovare articoli scientifici?"

2) Is the patron reporting an issue or making a request related to the services provided by the Kiesow library?

Examples: "Visitor: 14:50:33: Dal coma al reinserimento : psicostimolazioni cognitive e trattamento dei disturbi comportamentali nel paziente post-traumatico"⁷

"Visitor: 10:16:06: Life Themes : A theoretical and empirical exploration of their origins and effects" [...] "Maria Vittoria: 10:19:26: non siamo abbonati a quel fascicolo

Maria Vittoria: 10:19:41: perciò potrai chiedere un document delivery".

In all the above-listed exchanges, support was provided by operators working in the University of Turin digital library office. Yet, patrons were also advised to ask for further help to the subject librarians working at Kiesow library to receive complete and detailed information about all the services and facilities the Library of Psychology could offer.

Text processing methodology

In order to manage the different chat log files in a convenient way, a number of pre-processing activities were carried out. The first problem we had to face after collecting all log files was the need of merging them into a single document. During this activity, attention was paid to leave the chronological sequence of the user-operator exchanges unchanged. The next step regarded the design of a script⁸ which could help to automatically recompose all the chat utterances that were split over multiple lines (see Figure 1). This script was carefully designed to preserve the chat formal structure by keeping all the questions and answers as single text lines (see Figure 2). Since all log files are made available by the SnapEngage chat management system in a CSV (Comma Separated Value) format, each log line contains 31 information fields (see Figure 3).

Visitor: 14:00:12: - BIOCHIMICA (VI edizione)

Visitor: 14:01:12: - Siliprandi-Tettamanti -"Biochimica Medica"-

- Horton-Moran-Scrimgeour-Perry-Rawn - Principi di Biochimica - IV ed.-Pearson Prentice Hall Ed.

- Lange Harper - Biochimica - 26/Ed. - Mc Graw Hill Ed.

Maria Vittoria: 14:01:34: sono tutti ebook?

Visitor: 14:01:51: no... sono libri consigliati

Figure 1 - split log lines

Visitor: 14:00:12: - BIOCHIMICA (VI edizione)

Visitor: 14:01:12: - Siliprandi-Tettamanti -"Biochimica Medica"- - Horton-Moran-Scrimgeour-

Maria Vittoria: 14:01:34: sono tutti ebook?

Visitor: 14:01:51: no... sono libri consigliati

Figure 2 - recomposed log file lines

Type
report url

Chat ; Offline
[https://www.snapengage.com/...](https://www.snapengage.com/)

⁶ For the sake of clarity, it must be underlined that only generic librarians were involved in the virtual reference pilot project.

⁷ This is an exam preparation book which can be borrowed in accordance with the specific regulation of the Library of Psychology.

⁸ All processing scripts were developed using the open-source GNU version of AWK

page url	http://95.172.89.157/primo_library/...
entry page url	http://95.172.89.157/primo_library/...
referring url	
date and time	31/01/2014 10:36:42
visitor email	unknown@example.com
visitor IP	2.40.56.55
visitor first message	ciao grazie!
visitor lat	45.062902
visitor long	7.678490
visitor country	Italy
visitor region	TO
visitor city	Turin
visitor browser	Firefox 26.0
visitor OS	Microsoft Windows 8
chat agent IM	wc:mariavittoria.muzzupapa@unito.it
chat agent alias	Maria Vittoria
chat response time (seconds)	61
chat duration (seconds)	70
chat transcript	10:36:43: Ciao, se hai bisogno di informazioni su come funziona il servizio sono a disposizione su questa chat. Visitor: 10:36:43: ciao grazie!
chat responded	true
chat case id	b59d8433-3835-4cbc-8b51-69f9c606d57b
JS vars	
Keywords	
Operator vars	
Destination url	mailto:primo.sba@unito.it
Agent Survey Score	
Agent Survey Comments	
local date and time	2014-01-31T11:36:42+0100
Tags	

Figure 3 - chat log data fields

In all log files produced by the system, some specific fields were always left blank (see Figure 3). Besides, most information was not pertinent with our research purposes. Therefore, the merged CSV log file had to be processed by a single script which was specifically designed to perform the following operations:

- Use the “type” field to get the starting point of a new live chat reference exchange.
- Remove the contents of all fields apart the chat transcription.
- Insert a couple of XML tags “<chat>...</chat>” for delimiting any chat session (see Figure 4).
- Tokenize (Grefenstette & Tapanainen, 1994) all the exchanges between users and operators. To accomplish this operation at best, both emoticons and multi-word units comprising author names, work titles, publishers, bibliographic records and system messages were taken into account and properly managed (e.g. “Job Stress, Coping Strategies, and Perceived Health Status Among Thai Female Home-based Workers BY THEERARAT BOONKUNA”).

```

<chat>
Visitor : 10:36:43: ciao grazie !
Visitor : 10:37:26: ma posso trovare i libri di tutte le biblioteche del piemonte ?
Maria Vittoria : 10:37:44: no
Maria Vittoria : 10:37:52: Solo quelli di UniTo
</chat>

```

Figure 4 - chat exchange

After concluding all the step of the above-listed processing chain, a number of specific keywords were chosen to automatically select and extract from the entire log file all the chat exchanges which were tied to the library division of Nature Science and, specifically, to the library of Psychology.

To obtain the results presented in the paragraph “project results”, a simple script which was able to extract the block of text starting from the first keyword found in each user-operator exchange was designed. Text selection was performed by exploiting the regular expression pattern matching capabilities the AWK scripting language is featured with (Robbins, 2016). This aspect is highly relevant because it allows to implement incomplete keywords and character lists to locate the pertinent text fragments within the reference chat log file. To identify all the patron requests whose subject was related to the Nature Science group of libraries, the following keywords were implemented into regular expressions:

[Bb]iolog
[Cc]himic
[Ff]isic
[Ff]arma
[Kk]ieso
[Mm]atem
[Pp]s[iy]c
[Ss]cienti

The usage of square brackets is required when different characters should be alternatively tested. In the examples above, brackets are used to manage both case sensitivity and possible language-related lexical variations (e.g. “psic” - it vs. “psyc” - en).

Narrowing the selection of texts to those reference exchanges whose subject is strictly tied to the library of Psychology was possible by adopting the following keywords:

[Aa]pprendimen
[Cc]ognit
[Cc]omportam
[Dd]isord
[Dd]isturb[oi]
[Ff]igli
[Mm]adr

In Italian the word “disturbo” and its inflected forms (e.g. “disturbi”) take two different parts of speech. They may be considered as one of the conjugated versions of the verb “disturbare” (to disturb, bother) or a noun meaning “annoyance”, “disturbance”, “illness”, “trouble”, “malfunction”, etc. In our chat log file both the mentioned parts of speech and some of their meanings were found. As a consequence, to automatically filter and limit the overall number of results to those contents expressing psychology-related questions only, the whole phrase context was taken into account. In particular, the determiner “il”; pronouns like: “mi”, “ti”, “la”, etc.; adverbs or adjectives like: “non”, “nessun”, etc. and the verbs “scusa” and “scusi” were implemented into the pattern matching regular expression. All the mentioned lexical items were logically organized by using both the conjunction (AND) and disjunction (OR) operators.

The sentences listed below clearly demonstrate how phrase context is able to functionally select the meaning of the keywords “disturbo” and “disturbi”. In the first three examples patrons use “disturbo” to express concern for the possibility of annoying the operator with their questions. The example 4 shows that the word “disturbi” may be combined with the negation “non” and the pronoun “mi” to reassure the user that his/her reference requests were not a bother. Examples from 5 to 8 show sentences in which “disturbo” and “disturbi” express illness-related physical conditions. In example 8 the plural noun “disturbi” shows a different meaning if compared to its singular counterpart of example 3, where the presence of the verb form “scusa” (sorry) allows to understand easily the keyword sense.

1. scusa se ti disturbo, ma io non posso vedere l'intero documento, posso solo vedere se è presente in biblioteca, giusto?

2. mi scusi la disturbo ancora, possibile che non mi dia risultati alla ricerca ??
3. Ti ringrazio! Scusa il disturbo! Buon Lavoro!
4. non mi disturbi
5. gli articoli sul disturbo borderline collegato alla criminalità, comunque ho provato ad aprire anche quelli che avevo già visto gli altri giorni e mi compare la stessa scritta
6. le parole chiavi sono figlicidio altruistico e disturbo paranoide nella madre
7. Dal coma al reinserimento : psicostimolazioni cognitive e trattamento dei disturbi comportamentali nel paziente post-traumatico
8. L'argomento sarebbe la correlazione tra i disturbi legati all' apprendimento della matematica e la memoria visuo-spaziale in relazione poi al gioco.

Project results

After running all the chat file processing scripts, data demonstrated that 193 reference requests from University of Turin patrons involved scientific libraries. They represented the 8% of all the chat exchanges.

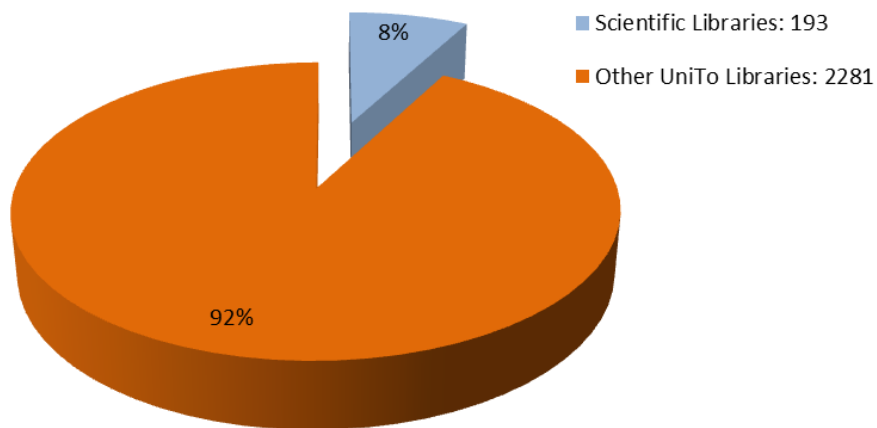


Figure 5 – virtual reference requests to the UniTo Scientific Library section

Among the scientific libraries, 121 patron requests - corresponding to the 62,7% - involved the Library of Psychology in different ways.

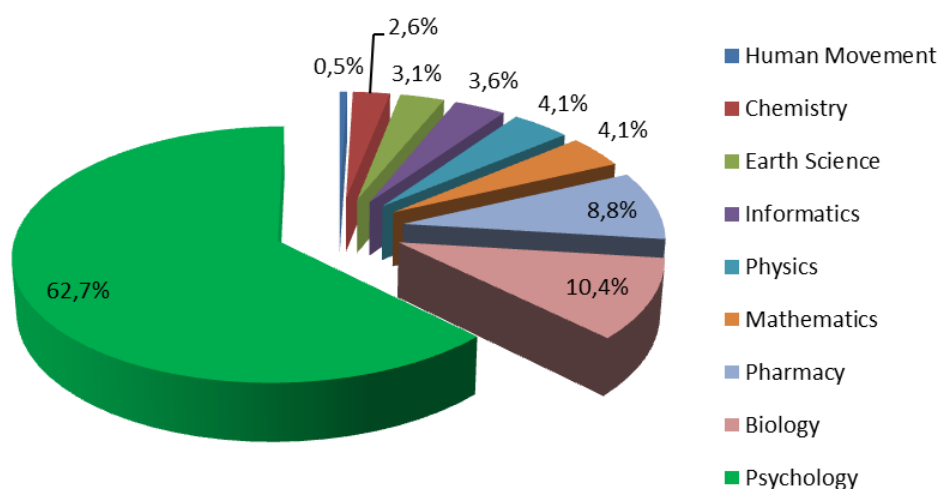


Figure 6 – virtual reference distribution within the scientific libraries

Statistical values derived from our semantic analysis show that 56 of the 121 interviews that we took into account (46%) responded to the three highest levels of the READ Scale and, consequently, were entitled to receive support from a subject librarian. The remaining 65 interviews (53,8%), although somehow tied to the Psychology area, responded to the lowest levels of the READ Scale and, therefore, the intervention of generic librarians could be sufficient.

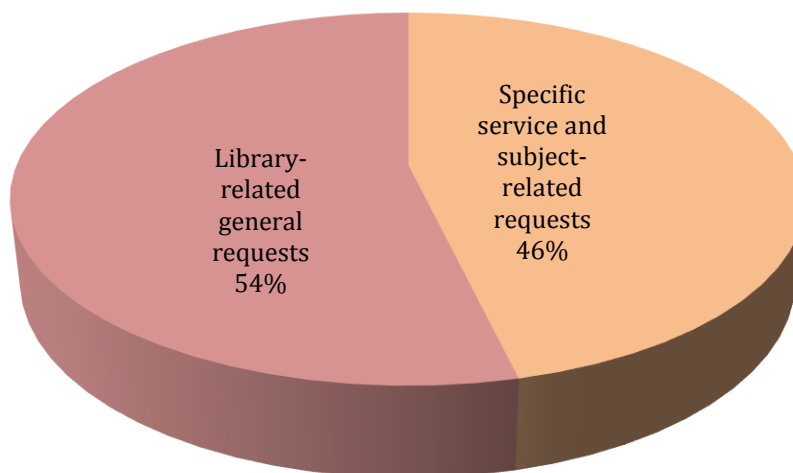


Figure 6 – Psychology-related virtual reference requests according READ Scale

Conclusions

This paper has described the analysis methodology which has been adopted to process the University of Turin virtual reference exchanges logged from 2014 to 2016. This study aimed at verifying whether the number of reference requests that patrons addressed to the Library of Psychology required the activation of a dedicated live chat instance. The results of our study confirmed the validity of our theoretical and methodological premises and demonstrated the usefulness of a semi-automatic approach to help select and categorize the various patron requests according to a standard framework.

Future development of this project will aim at integrating the mentioned analysis criteria with new keywords. This action represents the first mandatory step to process all the remaining

reference requests whose subjects could be addressed to other University of Turin libraries. By doing this, a clearer picture of our patron needs can be obtained and, consequently, the evolution pathway the virtual reference service should undertake may be set.

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