



Chatbots in the library: is it time?

Chatbots in the
library

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Abstract

Purpose – This paper aims to describe a pilot at the University of Nebraska-Lincoln for a chatbot that answers questions about the library and library resources.

Design/methodology/approach – The chatbot was developed using a SQL database to store the question and answers using artificial intelligence mark-up language metadata. The user interface was built using PHP, adapted from Program-O. The open source PHP program was modified to support better display and the launching of URLs within the chatbot screen. Database content was created by “mining” library websites for information, and analyzing chat logs.

Findings – The chatbot answers questions from a variety of users from around the world. It has attracted an unexpected number of social chatters, which required some additional metadata to accommodate personal chatting and to guide questions back to the intent of the project. The majority of questions are directional or factual questions that Pixel can handle. The database proved to be practical to build and revise as library resources and personnel changed.

Practical implications – The chatbot provides a 24 hour, seven day a week service that is consistent, can be enhanced as resources, services, or staff change, and provides a playful interface that engages users. It replaces complicated navigation systems and scrolling through search results with more targeted answers, and has the ability to refer questions to librarians.

Originality/value – Although chatbots have been around for several decades, there is a scarcity of reports in published library literature about their use in libraries.

Keywords Chatbot, Artificial intelligence, Reference, Libraries, Library users, Library facilities

Paper type Case study

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Introduction

Technology is changing the way we communicate. Today’s students thrive on social networking tools like Twitter, Facebook and Foursquare. Chatbots are not usually included in this grouping but they engage users with a playful interface that is familiar to a generation that grew up with online games. On a recent posting by Beloit College about the incoming class of freshmen who will graduate in 2015 (www.beloit.edu/mindset/2015/): “They’ve always had the privilege of talking with a chatterbot.” Libraries are seeking ways to engage this generation and should consider the chatbot as another tool for reaching users who expect more than a flat website.

This paper is about adapting artificial intelligence technology for reference services. AI has come a long way as IBM’s Watson demonstrated when it won “Jeopardy” in February of 2011. The advances in artificial intelligence (AI) combined with the availability of online resources make it time to consider artificial intelligence as a tool for the library.

Chatbots (also known as conversational agents, artificial conversation entities, or chatterboxes) are computer applications that imitate human personality. A chatbot is interactive, responding in sentences that track the conversation in a way meaningful to humans. This characteristic of mimicking discourse appeals to library users who want a more interactive library experience, something livelier than a search engine, and fits well with the socially directed students we are seeing on our campuses.



One of the selling points for these bots is their ability to handle common directional and predictable questions. They excel at routine, repetitive tasks that can free librarians from the most common questions. Bots flatten a website; when someone chats with a bot, they do not need to know the layout of the website, or the resources available to them. The chatbot is programmed with that information and pulls together the necessary sources, reformatting and presenting it in a manner that meets the needs of the information seeker.

Can a chatbot truly replace the experience someone gets in a reference interview? Is it even possible to identify the best characteristics of a reference experience and develop a program algorithm that will reproduce that experience? In a 1996 study undertaken by Nardi and O'Day (1996), the authors analyzed the activities of face-to-face reference sessions to determine the best characteristics of "human agents." They identified two major characteristics of the reference session: personalization of searches with respect to the client's specific activity (they must know something about the client), and collaboration with the client to clarify and adjust the search. They further identified the types of searches they thought were best suited for a computer agent: monitoring (searches based on terms provided by the searcher and are often repeated for updates), planned (multi-step information-seeking that involves several searches) and exploratory (undirected searches).

Chatbots can handle known repetitive searches by programming the searches into the bot responses. Chatbots can also handle basic multi-step searches through a more complex series of questions and answer algorithms. Exploratory searches are more challenging, but a chatbot can provide general guidance and make referrals to librarians for additional assistance.

Text messaging and chat services are becoming popular reference services in libraries, and both are similar to a chatbot experience in that neither are face to face and involve a technology interface. For this reason, we may be able to apply lessons from human chat session to the design of a chatbot. A 2010 analysis of a chat log at the University of Nebraska-Lincoln revealed some interesting patterns.

This study of over 500 chat sessions (Figure 1) indicate that 34 percent of the searches were inquiries about database subjects or look-ups for specific titles, which approximates the monitoring category in the Nardi/O'day study. The next highest percentage, 16 percent, involved questions about services (how do I renew a book, etc.).

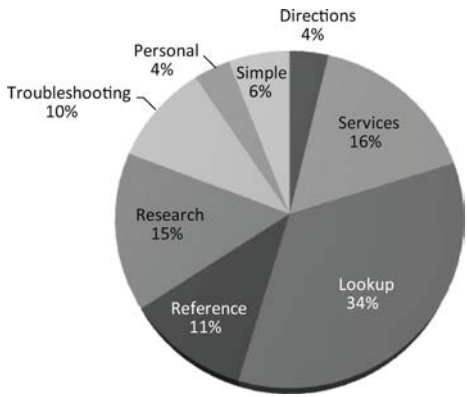


Figure 1.
A study of over 500 chat sessions

The next category was 15 percent for research questions, which would equate with the exploratory and planned searches in the Nardi and O'Day article. Reference (ready reference), which Nardi and O'Day decided not to explore, represented 11 percent of the chat questions. A total of 10 percent of the queries were about system problems (login authentication issues, etc.). The last three categories were simple answer questions (6 percent), personal (4 percent) questions that involved non-library issues, and directional inquiries about where to find something (4 percent). A deeper analysis of the logs shows evidence of the personalization and refocusing behavior noted by Nardi and O'Day that was important in the reference interview. Overall, the chat questions in the UNL log appeared to be quite varied and sometimes resulted in referrals to librarians when the question appeared to be too difficult or complex.

Why do people select chat over reference services? A 2005 study by Ward (2005) found chat services were used by graduates and undergraduates for a variety of reasons: it was quicker (48 percent), the library was too far away (16 percent), had heard good things about the service (10 percent), did not like asking question in person (5 percent), was the only place to go (4 percent), and other (15 percent). These reasons were independent of the type of question so Ward concluded libraries planning to offer chat should expect to "field all types of questions." Whether or not librarians approve, clearly any chat service must be able to handle just about any type of question. Fortunately, the availability of on-line resources makes it possible to program a chatbot with this functionality.

Returning to the first two characteristics in the Nardi and O'Day article, it would be difficult with current technology to satisfy the personalization of the search process, or the collaborative refining of searches that occurs in one-on-one reference sessions with software. However, through the use of a conversation agent, it is possible to come close. The artificial intelligence in chatbots can be built using concepts from natural language interaction (NLI). The advantage of NLI processing is the ability to use the phrasing (verbs, nouns, adjectives, etc.) from the input to supply an answer that is more sensitive to the intent of the question. There are two different types of NL: text-based chatbots where the interaction is supplied through text input and output, and embodied conversational agents where the interface is represented by a figure with a body and or face that interacts with the user, and may include audio. For example, there is a talking chatbot for practicing English in the EFL Classroom 2.0 (<http://eflclassroom.com/bots/ebot2.html>). In both cases it is possible to include conversational elements that simulate a real conversation.

The web holds valuable information that a chatbot can search, libraries subscribe to databases that hold dynamic information that is readily available to chatbots. The new bots can tap into siloed resources, retrieve information and repackage in much the same way as a discovery tool, but with the ability to seem more human than a search engine.

Chatbot technology has been around for some time, but libraries have been slow to adopt the technology. Rubin and Chen reported in 2010 that among Canadian libraries, "none of the top 20 surveyed libraries employed embodied conversational agents for any of their on-line accessible services. As for text-based NLI applications, there was one approximation" (Rubin *et al.*, 2010). This was from the University of Western Ontario which used a text-based agent "Ask Western Libraries" to retrieve the best matched answers from FAQs, which replaced the scrolling lists that came back from search engines.

European libraries were the first to explore chatbots, most notably the Stella experiment (www.sub.uni-hamburg.de/bibliotheken/projekte/chatbot-stella.html) at Bibliothekssystem Universität Hamburg. The Stella chatbot is under renovation and at the time of this article is inaccessible. Two public libraries in the US, Mentor Public Library (MPL) and Akron-Summit County Public Library (ASCPL), are cooperating on the development of chatbots (they call catbots) to provide help and guide users to the catalog to answer questions about the availability of materials, and user accounts. They used artificial intelligence mark-up language (AIML) metadata to create the bots using the Pandorabots (www.pandorabots.com/botmaster/en/home) hosting service. AIML is a metadata scheme developed by Dr Richard Wallace and has been adopted by a large open source community of users under the stewardship of the ALICE AI Foundation (www.alicebot.org/aiml.html). Table I lists current library chatbots found on the web.

The University of Nebraska project

Academic libraries in the US have been slow to adopt chatbots. The University of Nebraska-Lincoln chatbot is the first to go into production. Development for the chatbot, pixel (<http://pixel.unl.edu>) was begun in the fall of 2010. Pixel is hosted locally in a SQL database and was built using the open source PHP interpreter designed for AIML called Program-O (www.program-o.com/launch/). AIML was selected for two reasons: first, the metadata structure is flexible to accommodate the variety of questions coming from library users, and secondly, because of the availability of AIML files that have been contributed by the open source community. These community files provided the basis for development of the library specific metadata, but in some cases were revised to better fit the purpose of the UNL chatbot.

Pixel supplies answers to user questions entered in natural language in brief text responses. These answers are formulated by a match on keyword and keyword combinations from a database of AIML categories. The categories supply answers to specific questions, and make referrals to library staff. The latter is important because

Library site	Bot name	Chatbot URL
Akron-Summit County Public Library	dewey	www.akronlibrary.org/dewey.html
Free University of Bozen		http://web.inf.unibz.it/bob/?popup=yes&language=en
Kornhaus Bibliotheken		www.kornhausbibliotheken.ch/index.php?option=com_wrapper&view=wrapper&itemid=64
Library of Dresden	Slub	www.slub-dresden.de/
Mentor Public Library		www.mentorpl.org/catbot.html
Mentor Public Library	Emma	www.mentorpl.org/catbot.html
Staats- und Universitätsbibliothek Hamburg	Stella	www.sub.uni-hamburg.de/
Universität Dortmund	ASKademicus	www.ub.uni-dortmund.de/chatterbot/
Universitäts- und Stadtbibliothek Köln	Albot	www.ub.uni-koeln.de/nmlQ/Albot_html.jsp
University of Nebraska-Lincoln	Pixel	http://pixel.unl.edu
Libraries		
University of Wolverhampton Library	Lisa	http://lisweb.wlv.ac.uk/chatbot/

Table I.
Current library chatbots
found on the web

we are far from the time when software can provide the level of support (both knowledge-based and emotional) that a reference staff member can provide. The key for this project is to find the balance between the user's need for a quick answer (the machine's efficiency) and the need for the chatter to understand the research process (librarian's knowledge).

Pixel provides an interactive experience that mimics a human conversation, while giving immediate answers to questions about library services and resources. Pixel flattens the website so users do not need to interpret the website and navigate through pages to find the specific information they are seeking. It is also designed to guide researchers to appropriate resources and help them solve problems in a similar way as the more conventional FAQ. The major difference between Pixel and more conventional tools is that Pixel simulates a reference interview and provides direct responses based on the syntax of the query that can pull together library resources.

The libraries provides access to licensed databases, and innovative interfaces (www.iii.com/) products that include: Encore (discovery tool), ResearchPro (aggregate search engine), and webpac. The libraries also manages DigitalCommons (Institutional Repository for UNL), and ContentDM for image collections. All of these resources are integrated into Encore, but there are other resources like LibGuides (www.springshare.com/libguides/) and the main website at <http://libraries.unl.edu>, which are incorporated into Encore. The chatbot Pixel incorporates all of these resources into the context sensitive responses "she" generates.

The user interface designed for Pixel is basic. It consists of a typewriter- like response to the questions entered with a keyboard. An "iFrame" window will display the contents of the first link in a response in a box that appears below the chat session. A user enters her question and a query is sent to the database which finds, or does not find a match, and then responds either with the match or a pickup line. Figure 2 shows the main screen where a conversation begins.

The metadata supports the ability to "chain" a conversation. This is accomplished when Pixel asks a follow-up question in response to the initial input. Based on the user's answer, additional information is provided. Using this Q&A approach surprisingly complex conversations can be held between the bot and the chatter. Figure 3 diagrams the QA system of query and response.

Development phase

The development phase occurred from October 2010 through January 2011. During this time development consisted of the following activities:

- (1) Install Program-o.
- (2) Load open source contributed AIML files into the database.
- (3) Evaluate and revise the contributed files. This included removing the personal references that were contributed by members for social conversations. These responses included categories like, "what's your sign", or "do you enjoy being a woman". The "pickup lines" (responses developed to keep people interacting with the bot) were also revised into open ended statements to suggest appropriate library related topics, for example changing "oh, you are a poet" to "are you are looking for a specific title, say lookup followed by the title and I can check for you."



Figure 2.
The main screen where a
conversation begins

- (4) Examining the library website and extracting facts that were turned into categories. For example, the circulation policies were dissected into specific question and answers.
- (5) Examining chat logs from the reference department and adding categories for questions and answers.
- (6) Examining Google Analytic logs for Encore and Classic Catalog to include frequent searches.
- (7) Examining FAQ's from other libraries to identify and include frequently asked questions.
- (8) Daily monitoring of the Chatbot logs to identify and correct omissions or improve question answers.

Pixel went public in February 2011 and was introduced to the UNL community through the What's New and BetaZone web pages on the libraries' website <http://libraries.unl.edu>. In addition, staff periodically "tweeted" about the chatbot and publicity information was added to the libraries' Facebook account (www.facebook.com/pages/UNL-Libraries-University-of-Nebraska-Lincoln-Libraries/87086676278). The goal of the first six months was to build the database so Pixel could answer 95 percent of the questions. The chat log was a valuable source for refining and supplementing the database and resulted in modifications of the pick-up lines and topic areas.

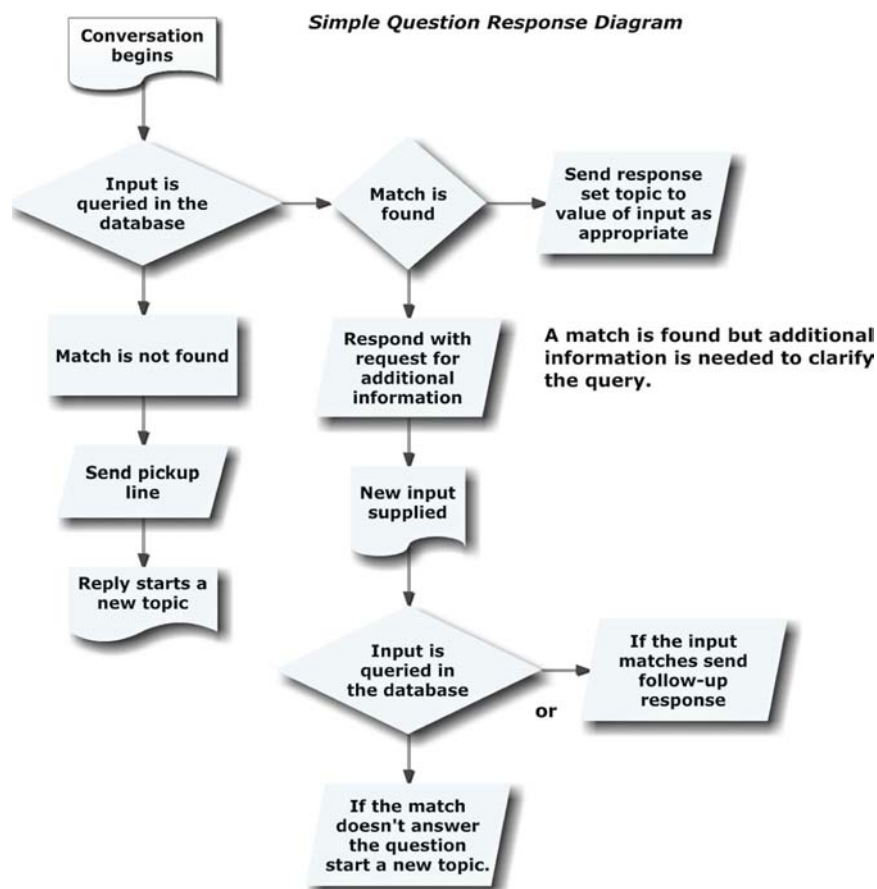


Figure 3.
The QA system of query and response

We discovered that Pixel is particularly appealing to social chatters, who often prefer to chat with the bot on a personal level over asking library related questions. This required some modification of the categories to accommodate users' need to play with the bot, and attempt to redirect their conversations into library related areas. In turn, these strategies led to improvements in the chatbot responses by adding suggestions that would help the chatter state their request in successful terms the chatbot could follow. Figure 4 is an example of a chatbot session where Pixel's response leads the chatter to enter a follow-up request (or refinement of the question).

Pixel's metadata

AIML file sets are text files identified by the file extension AIML, and consist of categories (question and answer metadata) that are usually grouped by content into associated filenames. With the exception of two files, *atomic.aiml* and *default.aiml*, the file naming convention is only important in managing workflow as the files or organized based on content for easy identification. For example, we put all the categories about subjects in one file named *subjects.aiml*. Categories in *atomic.aiml*

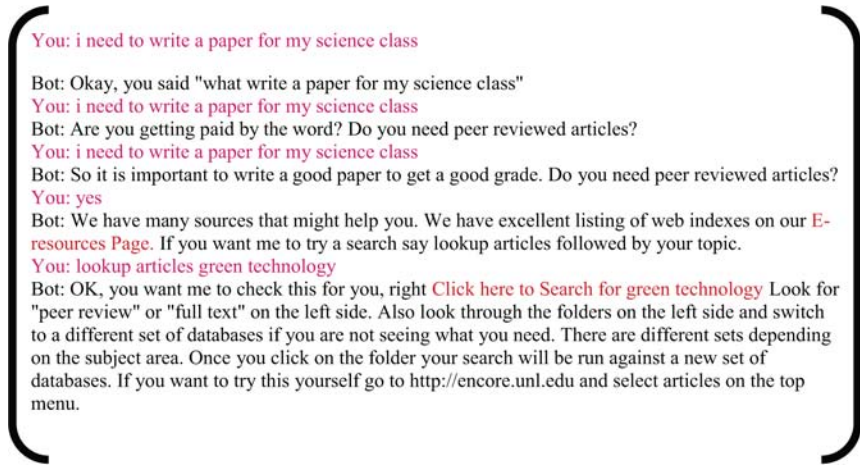


Figure 4.
An example of a chatbot
session

The label “you” precedes the chatters input and “bot” labels the response from the bot. AIML metadata for questions and answer process allows us to develop varied responses that keep the attention of the chatter.

match prior to categories in default.aiml, and both take precedence in matching before other file categories. These two file categories handle general conversations and are supported by the open source community.

Each AIML item consists of a metadata tag group that opens and closes with category, which marks a single record for the database. The question matching section has the opening and closing tags of pattern, the bot’s answer is tagged with opening and closing template metadata. The answers can include URLs that have the capability to pass questions directly to a search engine. The following example demonstrates the flexibility of the application:

```
< category > < pattern > * CRIMINAL JUSTICE * < /pattern > < template >
< srai > * CRIMINAL JUSTICE < /srai > < srai > xfind < star index = “2”/>
< /srai > < /template > < /category >
```

The above category contains a srai tag to redirect to the subject category of * CRIMINAL JUSTICE. This reference is necessary because the user will have entered words after criminal justice (indicated by the trailing asterisk) and without the second category there would be no match. In this example there are two references, “* CRIMINAL JUSTICE *” and “xfind < star index = “2”/>.” The xfind reference will do a second query using the content of the words that followed criminal justice. The main purpose of the reduction categories are to map the user’s language into the language of one category field. Using reductions it is possible to create only one answer to multiple ways the question might be answered. In the previous example, the actual bot response if found in the category * CRIMINAL JUSTICE:

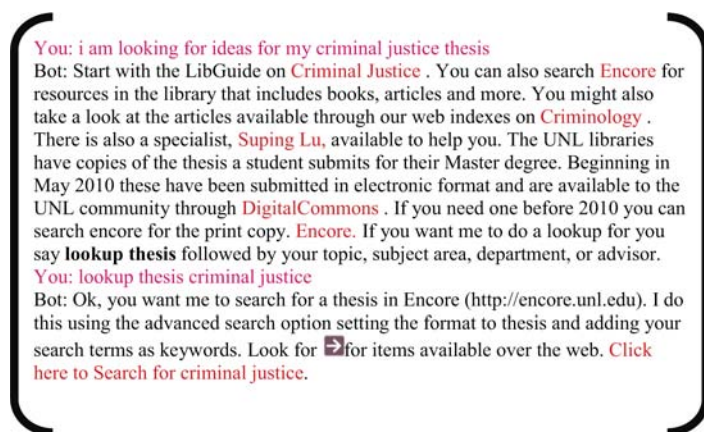
```
< category > < pattern > * CRIMINAL JUSTICE < /pattern > < template >
< think > < set name = “it” > < set name = “topic” > criminal
```



```
justice </set > </set > </think > Start with the LibGuide on <a target = "_new"
href = "http://unl.libguides.com/criminaljustice" > Criminal Justice </a > . You can also
search <a target = "_new" href = "http://encore.unl.edu" > Encore </a > for resources in
the library that includes books, articles and more. You might also take a look at the articles
available through our web indexes on <a target = "_new" href = "http://library.unl.edu/
search/?searchtype = f&amp;searcharg = criminology" > Criminology </a > . There is also
a specialist, <a target = "_new" href = "http://unl.libguides.com/profile.php?uid = 28753"
> Suping Lu, </a > available to help you. </template > </category >
```

The above examples demonstrate the use of the optional topic metadata which sets the topic for subsequent use. The “_” and “*” are important symbols that store the content of input into variables for later use and are also used for global matches. They are repeatable and function like a wildcard accepting any value. The “_” is used with caution in matching since it overrides all other matches. The “*” is a soft match and will match only when nothing else matches more exactly. Figure 5 is an example of a conversation that matches these examples:

There are several predicates useful in forming replies. The person predicate reverses personal pronouns so the bot seems to be following conversations. The “star” acts as a variable and stores the input from a “*” or “_” as a variable. This is used to send direct queries to Encore to look for specific titles, authors or subject areas. When there are multiple variables that are matched, it is possible to assign each variable independently by referring them with the index tag. In the first example, *CRIMINAL JUSTICE *, the second asterisk is referenced < star index = “2” > , which initiates a second search using the content in the second variable. Set name and set topics provide a means to tailor responses to the context of the conversation, enabling the chatbot to follow conversations. It can reduce the ambiguity that occurs in lengthy conversations where following the topic is important in understanding the content of the



The chatbot has matched the keywords “criminal Justice” and “thesis” and combined them into one response. The chatter then asks Pixel to do a lookup for criminal justice thesis using Encore’s advance search option.

Figure 5.
An example of a conversation

conversation. This technique was used extensively in the development of the categories for American presidents. It stored information about the particular president, vice-president, and any other information so follow-up questions would be answered. Figure 6 is a conversation that includes a follow-up question. Because predicates are used the bot understands that “who was his vice-president” refers to President Taft.

The primary algorithm in Pixel is simple question and answer. The chatter asks a question and the bot responds from the database. However, when appropriate as in the case of context sensitive questions, for example, “where is the bathroom” the bot responds with additional questions, in this example, “which Library are you in”, and then as appropriate, “which floor?”

For more complex situations, the topic can be used to create conversations that are unique to a particular context. A topic is a classification for the conversation and matches on other categories with the same topic. Topics are useful when the context of the conversation would result in different answers. Pixel employs topics for different user groups. Distance education students, community users and pre-college students will get different answers when Pixel has that information.

Another tool for maintaining conversations is the “that” field designator. It contains a match point from the bot’s previous response. This is particularly useful when the chatbot needs additional information to clarify the user’s question, or to provide a follow-up response. For example, when the input is a question about interlibrary loan, the bot responds with basic information on how to use it, where it is, etc. The user replies that she is missing some information that the ILL request form requires and does not know what to do. The question matches another category that provides additional information on completing the form because of a match (from the initial bot response) on the “that” field (Figure 7).

Pixel is not being designed to answer complex research questions – those will be referred to subject librarians. Pixel is designed to answer directional questions, questions about services and policies, and to direct chatters to general purpose

You: who was the 27th president

Bot: William Howard Taft was born Sept. 15, 1857 and died Mar. 8, 1930. He was the 27th president, serving from 1909-1913. He also served later as a Chief Justice of the Supreme Court. He had a strong background in the law and also worked as the Solicitor General of the US, and a judge on the US Court of Appeals. Image from <http://www.whitehouse.gov>.

You: who was his vice-president

Bot: James S. Sherman was William Howard Taft's Vice-President.

This metadata stores information about the category for later reference:

```
<think><set name="he"><set name="topic">William Howard  
Taft</set></set><set name="vp">James S. Sherman</set></think>
```

The “think” tag hides the text from the chatter.

Figure 6.
A conversation that
includes a follow-up
question

You: I can't figure out interlibrary loan

Bot: Do you need to get something? Well you have come to the right place we have a crack Interlibrary Loan Team that will retrieve what you need lickidy split. Just look for the WebBridge button any screen and click on it, the information from your citation will be copied into the ILLAD form. In a few days you will get an email notification that your item is available for pick-up, or in the case of fulltext availability, a link to the PDF. Can anything be easier? Here is the link to logon on to this [service](#). The ILL Office is located on the second floor of Love South (just before you enter the link). If you are a Distance Education student let me know because we have services just for you.

You: but it is asking for missing information i don't have

Bot: If you are missing some information, like volume and issue, when exporting to Interlibrary loan, check to make certain that the item is a journal. Sometimes books get imported to the wrong form. If that is the case select new request. For books, there should be an option on the WebBridge panel for a book request. Also please report any problems so we can work to them resolved. You can report problems using the "report it" link under "Other" in the WebBridge window. If it really is a journal and is missing information that the ILL form says is required, add a note to indicate that the citation didn't include that information. Notes are also a great place to let us know you only need certain pages.

The user response that he is missing matches on the following category because of the <that> tag with content from the bot's previous statement.

```
<category><pattern>* MISSING *</pattern><that>Do you need to get something
_</that><template>If you are missing some information, like volume and issue, when exporting to
Interlibrary loan, check to make certain that the item is a journal. Sometimes books get imported
to the wrong form. If that is the case select new request. For books, there should be an option on
the WebBridge panel for a book request. Also please report any problems so we can work to them
resolved. You can report problems using the "report it" link under "Other" in the WebBridge
window. If it really is a journal and is missing information that the ILL form says is required, add
a note to indicate that the citation didn't include that information. Notes are also a great place to
let us know you only need certain pages.</template></category>
```

Figure 7.
The initial bot response

resources. It is primarily a tool for undergraduates and researchers looking for quick information and tips on searching databases and conducting research. As such, Pixel sends factual questions (what is the population of the US) to Google.

One of the greatest challenges in building the database is getting chatters to make requests that have the best possibility of matching the database. This is not too dissimilar to the opening question in a reference query where the user starts with a question that from his perspective seems reasonable, but from the librarian's viewpoint needs clarification, for example, "I'm looking for something about [...]." This is where the pickup lines become useful. The original open source file responses were changed to questions that relate to the library. This simple list of pick-up lines is designed to guide the chatter back to a topic Pixel can answer:

- (1) Let me know if you are looking for books or articles.
- (2) Let me know if you need information about a library service.
- (3) Let me know if you are looking for a person who works in the libraries.
- (4) Are you are looking for a specific title, say lookup followed by the title and I can check for you.

- (5) Are you are looking for a database, let me know the field of study.
- (6) If this is your first research project, ask me about getting started.
- (7) Are you working on a class assignment, you are probably looking for reserves.
- (8) If you need peer reviewed articles, let me know.
- (9) If you are looking for pictures or images, try searching the image collection ContentDM.

Pickup lines are not helpful when the chatter enters misspellings (there is basic support for spelling correction), or uses the wrong word. These cases can even be challenging for the most informed librarian, for example, “That book with penguins on it” (an O’Reilly book on *Programming Collective Intelligence*), or when the patron is convinced that “alien weeds” come from another planet.

When the chatter enters information that does not match a category, Pixel responds with a pickup line, which attempts to get additional information that will match. Other useful devices are XFIND and `< sr/>`, which add the ability to join responses from multiple categories. This device is used when we want to prompt a social chatter to ask a question that is relevant to the library. For example, when the chatter asks Pixel for her name, the bot responds “Pixel,” and because `< sr/>` is added to the response template, one of the pickup lines is randomly selected and added to the response.

XFIND and `< sr/>` are added to join two separate categories when the question can be interpreted in multiple ways. The question, “what do you know about _,” is an open ended question that could mean many things. It could be a simple request for factual information or require more probing. The initial response includes a link to search Google with the user input. However, because the input could match another category, the XFIND addition will provide both categories. For example the question “what do you know about chemistry” returns the Google link that will search the term “chemistry” in Google, but it also matches a category chemistry which adds links to a LibGuide, databases, Encore, and the name of the subject specialist. The reduction `< sr/ai >` tags can also be added to a response to join two separate but related categories, however the `< sr/ai >` tag requires a named category, while the XFIND and `< sr/>` tags will accept the first variable of user input.

The ability to randomize answers is another feature of AIML that keeps the responses fresh. This is important for the social aspects of Pixel, when a particular answer is not important. When people ask the same question, Pixel will select a random answer from a list of possible responses. For example, if the chatter asks “what is your favorite database?” Pixel will select a random response from the database list. Using this random feature, a degree of unpredictability can be added to the Pixel’s responses to maintain chatters interest.

Conclusions

We have learned that it is impossible to predict what chatters will say to Pixel and because they know they are chatting with a bot, they will say things they would never say to a human. Looking through logs with profanity gets tiresome so we developed a topic area when Pixel will refuse to respond until the chatter apologizes. The responses of the chatbot have improved as the logs were mined, but the challenge has been keeping people interested enough to come back again and again when their first

experience may not have given them the answer they needed. We hope the “personality” aspect of the bot will entice chatters to return as the bot “learns.”

Pixel is still like a small child, learning with every interaction, gradually improving both in quality and complexity. Pixel will work 24 × 7 with less than 1 percent downtime, and will provide consistent answers. It searches across varied sources and brings together information in a similar way a librarian would work with a user. If we are successful in this phase, we will have a chatbot that can tap into a basic level of expertise compiled from subject experts (by mining Libguides and other information provided by the human experts), search hidden databases and suggest resources to bring together the best combination of answers to service questions with tips on research. Pixel will refer more complex questions to librarians, who can spend more time on research issues that require their expertise. There may come a time in the future, when we can reduce the amount of time we staff the reference desk, freeing librarians for more duties that require the skills that are unique to humans. It is doubtful that many reference librarians will cheer that day; many librarians, like most people, are reluctant to see technology take over even a small part of their jobs. Blacksmiths mocked the first automobiles, but we know how that ended. Should reference librarians be afraid of chatbots like Pixel? It is doubtful that will make a difference; technology consumes jobs and the race is on to build the better bot. In March of 2011 Google announced Google Talk Guru (<http://guru.googlelabs.com/>), an experimental service that allows people to chat with a bot to get information from Google. Should we wait to see the results of Google’s experiment?

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