The Role of Chatbots in Teaching and Learning

Introduction

A chatbot is a computer program meant to mimic human conversation and personality, and it can be used to have a simple conversation with a human participant. Some chatbots are built to try to fool people into believing that the program is in fact human. The history of chatbots and artificial intelligence itself is complicated and at times rife with fanaticism, arguments, and criticism. ELIZA was the first chatbot created in 1966 by Joseph Weizenbour; ELIZA worked on pattern matching and user responses to pre-written scripts. Dr. Richard S. Wallace [CITATION Wal03 \l 1033] created A.L.I.C.E in 1995 using the Artificial Intelligence Markup Language (AIML), which is an "XML-compliant programming language [CITATION ALI14 \l 1033]. AIML was developed by Dr. Wallace and the Alicebot Free Software Community; many new chatbots use some form of the Alicebot AIML knowledgebase. AIML still uses pattern matching, but patterns are kept short, and responses from multiple categories can be combined. This means that AIML can mimic natural language much better than the scripts used in 1966 with ELIZA. While fascinating, the history of chatbots and Artificial Intelligence (AI) is not the main focus of this chapter. Instead, we will focus more on understanding chatbots, their role as instruction and reference tools, and the development and analysis of the University of California, Irvine Libraries chatbot, ANTswers.

Understanding Chatbots

Chatbots can be programmed to hold simple, general conversations, or they can have a persona, like the "Santa Bot" (http://www.santabot.com/) or "Fake Captain Kirk" (http://goo.gl/ZQ07Ll.) Chatbots can also have jobs, helping out with customer service issues, virtual assistants, and as searchable frequently asked questions (FAQ). Sites like "chatbots.org,"

(https://www.chatbots.org/) provide an international list of developers, businesses, and chatbots. The forums for chatbots.org, Alicebot.org, and Program-O can be extremely useful as you consider the type of chatbot you might want to create, for AIML help, and general troubleshooting assistance.

Types of chatbots

There are two main types of chatbots: A "web-based" application which runs on a remote server and is accessed through a web page from multiple computers or a "stand-alone" application which runs on a single computer. A simple and basic web-based chatbot is a blank white web page with a form that is the sole interface between the patron and the bot. Anything beyond that, such as graphics, animations, or audio/speech recognition, is extra.

Web-based chatbots have advantages over stand-alone applications: web-based chatbots allow more control over bot behavior and personality, they can be accessed from multiple computers, and most can be hosted for free, though premium options are available. While stand-alone chatbots are easy to install and to use, you usually do not own the chatbots. This limits the amount of configuration that can be done to personalize the chatbot. Most chatbots, whether they are web-based or stand-alone, will require some understanding of AIML. A discussion and explanation of AIML is in an appendix to this chapter.

<p style="text-align:center">**Role of Chatbots in Instruction and Reference**</p>

Chatbots, with their pattern matching, natural language processing, and ability to connect multiple patterns to one response, are a natural fit for providing reference and instructional assistance. Nardi (1996) referred to a "diverse information ecology" in which librarians and chatbots can collaborate to perform different but related tasks to serve patrons. Creating chatbots offers a library the opportunity to enhance current reference and instruction services to serve a

large number of patrons and a wide range of people at any time of day. Reference librarians answer a diverse range of questions, from the simple to the complex. In a large academic library, a lot of these questions can be repetitive.

Connaway, Dickey, & Radford (2011) addressed the issue that librarians compete with other sources of information, including some that are more convenient, familiar, and easier to use. They stated that the "[patron] once built workflows around the library systems and services but now, increasingly, the library must build its services around user workflows" (p. 179). Academic libraries have instituted a number of in-person and online reference services to meet the information needs of their patrons. Some information needs require software or establishing future appointments.

There is also anecdotal evidence from reference and instructional librarians that patrons will sacrifice content for convenience. Being able to reduce the amount of clicks from search to resource gives librarians a greater chance of patrons accessing the information they need in a more convenient way. Library websites can be complicated to navigate and students sometimes have trouble remembering the paths to the resources they need or even the name of those resources. Chatbots can flatten a complicated website, enabling library users to access the materials and services they need in fewer clicks or without remembering paths of links to reach the resource they need. At the same time a chatbot can teach and model research skills and behavior to our library patrons through its responses.

With the ability to mimic human conversation and to use pattern matching to provide responses, chatbots can provide personalized services, offline help or aid in information acquisition. For example, a chatbot can answer questions, make recommendations and direct patrons to other online resources. Rubin, Chen, and Thorimbert, (2010) stated that human-

computer interfaces, and Natural Language Interaction (NLI) are an "effective" and "appropriate" complement to library services. Chatbots can also be used to augment and bridge gaps in library services and are meant to enrich the interaction.

Library patrons are highly mobile, not only rushing from place to place but sometimes accessing our resources from a distance. They need and want tools that are easy to access, reachable from any device, and available when they need them. According to Graves & Desai (2006), using virtual reference extends librarian reach to those who prefer not to or cannot come to the physical reference desk. Offering a simple to access web-based product to answer common questions provides patrons with the information they need even when they cannot come to our library.

Christensen (2007) wrote that chatbot conversation could appeal to library patrons who suffer from library anxiety or lack of library knowledge because of the anonymity chatbots provide. Having an anonymous chatbot that does not keep private information provides them an outlet to learn about services and resources in a space where they do not feel judged for the questions they are asking. Nardi & O'Day (1996) stated, and it is important to remember, that librarians can do things that chatbots cannot do, such as speak, read, understand content, make connections, and access non-electronic materials. Therefore, chatbots should not replace traditional reference and instruction services but can be used to enhance or fill gaps in traditional services.

Instruction

Through the Libraries' Education and Outreach Department, librarians and library assistants provide instruction for a major writing course (W39C) at UC Irvine. A chatbot can point students to a subject guide, answer questions about basic library services, explain library

terminology, and provide links to appropriate databases. ANTswers can support the library instruction by providing consistent answers and also by pointing students to the resources they might have forgotten how to access. Responses can be scripted specifically for their class and assignments. For example, W39C students are expected to incorporate state, national, or international policies into their papers. When students ask for policy resources, the chatbot can recommend appropriate resources for them to use as they start their research

Reference

Reference departments have a long history of offering virtual reference services to remote and on-campus patrons. The UC Irvine Libraries offer email, QuestionPoint, IM and appointment-based research consultations using tools like Google+ Hangouts. McNeal & Newyear (2013) state that requests for specific materials, locations, hours, and policies predominate in chat and IM conversations. Since these are the types of requests for information that chatbots can answer well, they offer a self-service option for patrons. Using online tools allows us to meet the patrons where they are located and at the point of need. AIML and chat robot software enables librarians to push the limits of offering assistance and instruction 24/7 without adding to a large suite of reference services requiring in-person assistance. With the recent economic issues, the cutting of library budgets, and the inability to hire new staff, creating a service that does not require a lot of staff support could be beneficial.

<div align="center">

The creation of ANTswers

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After attending a presentation on Pixel, the University of Nebraska-Lincoln's library chatbot, research was conducted to learn about chatbot creation and how to program in AIML. A chatbot for the UC Irvine Libraries was proposed in April of 2013. After approval was gained, a project plan and timeline was developed, and the implementation process was started in August

of 2013.   Implementing a chatbot can be a long process: the time from approval to beta deployment was approximately 11 months. Creating our chatbot, ANTswers, did not incur costs beyond the staff time to develop AIML code and the web-page.

Our situation – how does a chatbot fit?

Public services staff provide assistance in locating information through the selection and use of appropriate materials as well as providing orientations to the Libraries' online catalogs, web resources, services, and collections. One of the main purposes of reference assistance at the UC Irvine Libraries is to teach patrons how to locate, identify, and use resources so they can access information and do research. As a general rule, Reference Desk staff members are expected to teach patrons how to use resources rather than provide answers to questions. UC Irvine reference staff have a culture of teaching when providing in-person reference and that imperative was transformed and translated into how we handle online reference. For someone with a simple directional or factual question, some online tools can be complicated and an investment of time. A chatbot is accessed through a simple web page that requires neither contact information nor waiting for assistance. The chatbot's web page can also be mobile friendly so that patrons can receive help from their mobile device.

While reference librarians at UCI are accessible, they also have a wide range of duties, and there are times during the day when it might be difficult to reach someone. The UC Irvine Libraries offer a number of reference services to the UCI community to help them with their research and information needs:

- In-person Reference: Located at the Langson Library, our reference desk handles a diverse range of questions. Library assistants and librarians staff it for approximately 51 hours a week.

- QuestionPoint 24/7: QuestionPoint is a virtual reference management system, integrating chat and e-mail, UC libraries participate in the 24/7 Reference Cooperative.
- Email: Our email reference service is part of our QuestionPoint 24/7 system. The queue is checked twice a day Monday through Friday. We answer email questions and respond to QuestionPoint follow-ups in less than 24 hours (except for weekends).
- On Call Service (IM): At the Ayala Science Library (ASL), research assistance can be requested via IM at the check-out desk. Librarians then meet with the patron in person and help them with their information needs.
- Research Consultation Service (RCS): UC Irvine students, faculty, and staff may schedule a 30 minute consultation with a reference librarian to focus on their research needs.

The UC Irvine Libraries do not have extended reference service hours beyond our participation in the QuestionPoint 24/7 collective. We have, in fact, closed our science library reference desk and are using an on call system for helping patrons. Creating a chatbot allowed us to offer a service that is easy to access 24 hours a day and 7 days a week with minimal downtime. This can be useful when our main reference desk is extremely busy. All the chatbot responses could be written to be UCI-specific and responses can be consistent. One of the goals in developing the chatbot was to use the wording found on our library website as much as possible, thus ensuring conformity across services. Some editing took place to ensure friendliness or to make the text seem more conversational in tone. We also wanted the chatbot to mimic the UC Irvine Libraries reference style of not just providing answers, but to also provide instruction for future research needs.

In our human-mediated reference services, we describe the steps we are taking, sometimes explaining why they are important and showing patrons tricks and shortcuts. As much as possible we have tried to mimic that approach in ANTswers, but we also balance that with keeping the answers as short as possible. ANTswers' botmaster learned quickly that patrons don't always read our carefully scripted responses. The most difficult part of reading the chatlogs as a librarian is when we see that patrons did not receive the answer they needed because they missed the cue given to them. For the botmaster, it was sometimes difficult to understand what the patron was looking for so that an appropriate response could be scripted. These downsides are still minimal in comparison to the positive benefits of having created the chatbot in the first place.

Technology

ANTswers (http://antswers.lib.uci.edu/) is a web-based application run on a remote library server and accessed through a web page. A web-based chatbot allows the creator more control over bot behavior and personality, allowing the botmaster to determine how to handle mature content, profanity, and mischievous patrons. Web-based bots require at least minimal experience with the following: HTML, PHP, CSS, JavaScript, and AIML (Artificial Intelligence Markup Language). Program-O (http://blog.program-o.com/) is an open-source AIML engine written in PHP with MySQL. While there are several freely available and open-source AIML engines available, the UCI Libraries choose Program-O because of the features provided. Features such as spell check, bot personality settings, a SRAI lookup feature, and the ability to add and edit botmaster accounts.

ANTswers files were designated as bot files, conversation files, library files, ready reference files, and subject files. General conversation files are open source and were

downloaded from the Artificial Intelligence Foundation (A.L.I.C.E -

https://code.google.com/p/aiml-en-us-foundation-alice/) and have been edited as much as

possible to reflect neutrality on religion, politics, sex, race, etc. Files were created and edited

using Notepad ++, a free, open-source code editor for the Windows platform. While you could

also use Microsoft Windows Notepad to create and open AIML files, Notepad ++ maintains

formatting and also offers more functionality. The ability to search across files and within

folders is especially useful.

Development Team

ANTswers was built mainly by two individuals: a programmer and the Emerging

Technologies Librarian. The programmer wrote the background PHP files, designed the web

access page, and solved issues. She also wrote the original hours and chatbot "books or articles"

file.   The librarian led the chatbot task force through the process of determining the chatbot's

personality and what information it should contain. The librarian also used WorldCat FirstSearch

to develop the original Library of Congress keyword lists for the subject resource

recommendations. The keyword lists were shared with subject librarians, who were asked to

recommend 1-3 resources for each keyword. The librarian wrote most of the library-related

AIML. She continues to review all chatlogs and updates the AIML programming on a daily

basis. Creating ANTswers was a time-intensive project and the main two-person team received

assistance in implementing the project:

- A team of 13 made up a focus group to discuss the chatbot.
- A library assistant conducted an initial review of general files downloaded from

    A.L.I.C.E.
- A reference student assistant helped to create the subject files using a file template

    and Excel spreadsheets containing resource recommendations.

- A library school intern created our file for the UC Irvine Libraries Special Collections and Archives.

Project management

Development of the chatbot was split into the following phases:

Phase 1: Development & Focus Group (August - September, 2013)

- The focus group discussions helped determine the chatbot's look and feel, its personality, and what the chatbot should contain upon completion.
- In tandem with this, members of library Information Technology and Web Services created the back-end database, loaded and tested Program-O, and experimented with .aiml files.
- All subject librarians were asked to recommend 1-2 online resources (databases, journals, ebooks, etc.) for each of the Library of Congress subject terms. These recommendations became the Subject File collection, which contains 66 files.
- The botmaster spent approximately 15-20 hours per week editing open-source aiml files and creating new library related AIML categories.

Phase 2: Prototype (October - December, 2013)

- During this 10-week period, a lot of the library-specific code was created.
- A pilot web interface and graphics were determined.
- It was decided to run a library-wide contest for the name of the new beta service. The library Leadership Council voted on the submitted names. In the case of a tie, the University Librarian had final veto power.
- The botmaster spent approximately 15-20 hours per week editing open-source aiml files and creating new library related AIML categories.

Phase 3: Internal Test (January - February, 2014)

- ANTswers was made live for all staff of the UC Irvine Libraries to test its functionality.

- Library file creation was continued for approximately 10 hours per week while all

  logs were reviewed on a daily basis and categories were corrected or added as

  needed. Reviewing logs ranged between 5-10 hours per week.
- Statistics were not kept during this time period.

Phase 4: Beta Test (March - current)

- ANTswers was made live for all members of the UCI community and linked to on

  the library homepage.
- The ANTswers web interface was integrated into the overall UC Irvine Libraries

  web presence, and links to the service were added to the main library homepage.
- Conversation logs are checked on a daily basis, and categories are added or

  corrected as needed. The botmaster spends approximately 5 hours per week

  adding and editing categories. The amount of time spent should continue to

  decrease as the chatbot continues to improve.

About ANTswers

ANTswers is introduced on its main web page (http://antswers.lib.uci.edu/) as an

interactive Frequently Asked Questions (FAQ). There are different types of FAQ systems, from

simple lists of questions that can be clicked on to provide the patron with an answer to

searchable databases that return a list of results. The benefit of utilizing a chatbot over a

traditional web search is that it imitates a human personality. Instead of retrieving a list of results,

the library patron can have a conversation and receive one response.

Personality

ANTswers has a very distinct personality: he is modeled after the UC Irvine (UCI)

mascot, Peter the Anteater. Through his conversation, he presents himself as a welcoming and

factual anteater ready to help the UCI community with their information needs. When asked

about himself, his responses are all about UCI and being an anteater—from his favorite color being UCI blue and gold to his favorite meal being "ants in a white wine reduction." It was an early decision on the part of the focus group to indicate to the patrons that they are speaking to a computer program. We also decided to not only include library categories but also general conversation. Library patrons have been known to just "chat" with ANTswers.

Design

The ANTswers website is fairly simple in construction (see Figure 1). Under the title, there is information about connecting from off-campus, followed by the main conversation box. In the upper right above the conversation box are links to "About ANTswers" and "Terms of Service." These links give background information about ANTswers and also include a privacy statement that alerts users that beyond the chat logs, no personal information is kept by the system. In the upper right within the conversation box, there are links to clear the conversation, email the log, and to submit feedback on the service. Below our link to the Ask a Librarian page, a preview window opens whenever ANTswers answers the question with a statement that includes a URL. Library patrons can work within this preview window, click on links, save items, run new searches, etc. The preview window can even be popped out into a new tab if the patron would like to work with the resource in a larger window.

{Insert figure 1 and caption}

What Have We Learned From ANTswers

The feedback from some library staff was that the chatbot would only be useful if it could answer complicated reference questions. According to Allison (2012), "[chatbots] excel at routine and often repetitive tasks" (p. 96). Therefore, the original scope of the project was to focus on answering simple and repetitive questions, and the analysis of ANTswers usage

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supports this conclusion. The UCI Libraries Reference Department (2012), categorizes its

reference transactions using the following broad categories:

- Directional - Contact that provides logistical information, such as directions or schedules.
- Equipment - Contact that provides mechanical help with a device, piece of equipment,

    software, or hardware.
- Ready Reference - A substantive information source (owned/licensed by the Libraries or

    not) used to assist a patron or answer a reference question.
- Research - A transaction that involves the knowledge, use, recommendations,

    interpretation, or instruction in the use of one or more information sources (each of the

    substantive sources used to answer the question is counted as a Ready Reference).

The number of "research" level questions is very small at this time, the majority of questions

ANTswers receives are "ready reference," "equipment," and "directional" questions. This

finding is further confirmed by Christenson (2007). Chatbots did not "steal" reference questions

from traditional reference services. Instead, they take care of simple and frequently asked

questions.

Program-O maintains a log of every conversation and the chatlogs are reviewed by the

Emerging Technologies Librarian on a daily basis, Monday through Friday. The librarian

determines if each answer is appropriate, incorrect, or needs modification. Changes to the

appropriate files are made, saved, and then uploaded to Program-O. As each log is reviewed, it

is entered into a Google form and tracked for analysis. The statistics currently being tracked are:

- Date, day of week, and week in quarter

- Total number of questions asked

- Number of library questions asked, answered, and answer % rate

- Number of general conversation questions asked, answered, and answer % rate

- Question Type: ANTPAC, books, articles, hours, library locations, etc.

- Number of research, directional, ready reference, and equipment questions

In addition, we track the amount of time spent daily by staff in updating and correcting the .aiml files. On a weekly basis, we use Google Analytics to track the number of page views, unique page views, and the average amount of time spent on the ANTswers page.

Since the start of the public pilot in March of 2014 through September 2014, ANTswers has participated in 217 conversations and answered over 1,200 questions. An ANTswers conversation typically includes multiple library related and general conversation questions, on average 4 questions are asked per conversation, with the lowest number being 1 and the highest number being asked 24. Questions about the library are tracked separately from general conversation questions. In addition to tracking the number of questions asked, we track the number of correct responses. This allows us to measure the average answer rate throughout the pilot for both library questions and for general conversation. For the pilot, the average answer percentage rate for library questions is approximately 40%, and for general conversation, approximately 56%. While the answering percentage may seem low, the issues tend to be non-standard phrasing; i.e., using "rent" instead of "borrow," and unforeseen questions for which answers were not programmed, like where to sign up for language classes. As these are added to the database, the answering percentage should continue to rise.

It is important to note that we only focus on correct answers; if a patron's question gets an answer, but it is wrong or not appropriate, we do not count it. We are primarily using the answer percentage rate as a sign for when we should switch ANTswers from a beta product to a non-beta service. For ANTswers to no longer be considered a beta product we would like to see a 90%-95% answer rate for library questions. This might occur more slowly for ANTswers than for other library chatbots as there is only one librarian currently evaluating transcripts and

creating new files. The development of ANTswers also has to be balanced with the librarian's

other roles and responsibilities within the library. While this slows development down, having

only one staff member be responsible for adding and modifying current and new content ensures

that ANTswers maintains his "voice," by which he will appear more human.

By tracking the question type, the most common questions being asked can be charted.

In Figure 2 the types of questions being asked the most of ANTswers are hours, questions about

how to find books or questions related to books, and access services related questions about

borrowing, reserves, and Interlibrary Loan. As we continue the evaluation process, knowing what

patrons are looking for will help in making future improvements to ANTswers. Combining the

most common questions with text mining of all questions asked will help ANTswers

programmers determine priorities for files or topic areas that should be developed in the future.

{insert figure 2 and caption}

Rubin, Chen, and Thorimbert (2010) also mentioned that because of the complexity of

natural language, chatbot conversations can lead to awkward interactions. ANTswers can

produce strange responses at times because of its ability to both respond to library questions and

hold a general conversation. ANTswers works by matching each word that has been entered and

determining which category is the best match. If there is no perfect match, sometimes the

responses are muddled and are viewed by our patrons as "sassy" or "snarky." As its categories

grow and it can answer questions more reliably, negative feedback should diminish, and there

should be fewer strange combination responses.

Upon review of the transcripts, it is interesting to note when patrons assign personality

characteristics to a computer program. We do not hide that ANTswers is not staffed by humans

but is a program. Library patrons still tend to treat it as a person. We have had few problems

with inappropriate questions or language. The worst things that patrons say to ANTswers is that they sometimes don't like his responses and one conversation where the library patron said he hated the chatbot.

It is important to note that during the library internal test during phase 3, library staff had trouble separating what they thought patrons should be asking from what library patrons actually ask. This test was less successful than initially imagined because some library staff asked very complicated questions using library terminology that our library patrons do not tend to use in their requests for information. Since the main AIML programmer is also a reference librarian, she was able to prioritize staff questions and to determine what should and should not be programmed. Another challenge when developing the chatbot, even after it has been released, is that some library staff continue to have issues grasping the purpose of the chatbot.

Transferability

Libraries that have access to programmers, information support, and manage their own servers can easily install and develop a web-based chatbot. The main issue with the creation of a chatbot is the time it takes to create the large number of categories that are necessary for the chatbot to adequately answer questions.   ANTswers is currently composed of approximately 120 AIML files, which are split into 5 different collections. Conversation files are prepended with the letter "c" and are organized by the first letter of the <pattern>. Each file is then roughly organized alphabetically. There are 2 bot files, prepended with the letter "b," which contain categories that help remember information about the bot and the chatter. The 6 ready reference files are prepended with the letter "r" and give quick factual answers on various topics, like science, history, and geography. The 20 Library files are prepended by the letter "l" and organized by service, location, or resource.   Finally, there are 66 subject files which are

prepended with the letter "s" and contain resource recommendations for keywords. They are organized by Library of Congress classification.

The conversation, bot, and ready reference files are comprised of free and open source AIML sets authored by the AI Foundation and available at http://www.alicebot.org. These files have been reviewed, heavily edited, and organized for ANTswers. All of the files are available at eScholarship (https://escholarship.org/uc/uci_libs_antswers) under a Creative Commons Attribution-NonCommercial 4.0 license. The ANTswers collection includes individual files and a zip file for each collection so that each collection can be downloaded and edited to meet your institutional needs. While scripting a new bot from scratch is always an option, making our files downloadable and open source will allow other botmasters to modify, update and add on to existing library AIML programming.

Conclusion

ANTswers shows excellent usage for a beta product. Since its implementation in March of 2013, ANTswers has conducted 217 conversations with patrons and fielded over 1,200 questions. While the answer percentage (questions answered divided by questions asked) was initially low, it has increased over the length of the pilot. ANTswers performed as expected, primarily answering directional and ready reference type questions. Only 3 of the 158 conversations reflected a research level question. Research level questions, such as how to find data sets or statistics, can be difficult to answer in-person and they are difficult for ANTswers as well. This information is spread out over multiple LibGuides and it is difficult to determine one location to direct library patrons for information. If future statistics show that library patrons are continuing to ask questions about data sets and statistics, we may need to change our approach in how we handle these topics in LibGuides.

As we continue to evaluate ANTswers and make observations on patron behavior, we may gather insight into how we can change how we provide information for complicated topics. The ANTswers botmaster can already see that certain conversations on well-developed topics are getting a higher answer percentage rate. Further work needs to be done on non-standard language and non-academic library related questions to raise the overall answer rate. Staff and librarians at the UCI Libraries have already seen the benefit of having detailed logs of what patrons are asking for and, more importantly, how they are asking for that information. We have future plans to text mine the questions patrons have asked. We plan to integrate that information into our library website and the ways in which we promote various resources, tools, and services to our students.

While the initial .aiml files and code were written based on experience from various reference services that was just the start. The reviewing of logs and the additions and modifications made to the chatbot files were more important. Creating a library chatbot is truly a user-centered service. Librarians should remain cognizant of the fact that a library chatbot is not the answer to staffing or reference issues, but is just one tool that we can use to help our patrons.

BIBLIOGRAPHY

A.L.I.C.E. AI Foundation, I. (2014, September 30). *AIML: Artificial Intelligence Markup Language*. Retrieved from A.L.I.C.E.: http://www.alicebot.org/aiml.html

Allison, D. (2012). Chatbors in the library: Is it time? *Library Hi Tech, 30*(1), 95-107. doi:http://dx.doi.org/10.1108/07378831211213238

Christensen, A. (2007). A Trend from Germany: Library Chatbots in Digital Reference. Retrieved from http://www. tilburguniversity. nl/services/lis/ticer/07carte/publicat/07christensen

Connaway, L. S., Dickey, T. J., & Radford, M. L. (2011). If it is too inconvenient I'm not going after it: Convenience as a critical factor in information-seeking behaviors. *Library & Information Science Research*(33), 179-190.

Graves, S. J., & Desai, C. M. (2006). Instruction via chat reference: Does co-browse help? *Reference Services Review, 34*(3), 340-357. doi:http://dx.doi.org/10.1108/00907320610685300

McNeal, M. L., & Newyear, D. (2013). Chapter 1: Introducing chatbots in libraries. *Library Technolgy Reports, 49*(8), 5-10.

Nardi, B. A., & O'Day, V. (1996). Intelligent agents: What we learned at the library. *Libri*, 46(2) 59-88.

Rubin, V. L., Chen, Y., & Thorimbert, L. M. (2010). Artificially intelligent conversational agents in libraries. *Library Hi Tech, 28*(4), 496-522. doi:http://dx.doi.org/10.1108/07378831011096196

UCI Libraries Reference Department. (2012, September 17). Retrieved from Policies and procedures: Reference Statistics Category Definitions: http://staff.lib.uci.edu/refstats-docs.php

Wallace, R. S. (2003, March 28). *The Elements of AIML Style.* Retrieved from alicebot.org: http://www.alicebot.org/style.pdf

APPENDIX

AIML overview

While you may be concerned about learning AIML if you have very little programming experience, it is a relatively simple language to learn. As a matter of fact, the main programmer for the UC Irvine Libraries chatbot had only minimal experience with HTML prior to starting the chatbot project. Dr. Wallace states AIML "…dispense[s] with much of the conventional wisdom from structured Programming" (Wallace, 2003, p. 5). The tags <category>, <pattern>, and <template> are the basic units of knowledge for AIML, where *category* is the unit of knowledge, *pattern* represents the patron input represented by keywords, phrases, or questions, and *template* contains the chatbot response. A simple AIML expression can then be represented as <category><pattern>INPUT</pattern><template>OUTPUT</template></category>. Below is an example of a simple AIML category:

<category><pattern>I NEED HELP</pattern>

<template>Can you ask for help in the form of a question?</template></category>

Within the AIML basic unit of knowledge tags can also be applied. Tags can signal the need to the chatbot to save data, give conditional responses, and to activate other programs. The tag <srai> can accomplish many tasks. For example, it can reduce the complex to the simple, split and combine responses, handle synonyms, etc. It is particularly useful when there is a wide variation in the questions a library patron can ask that can result in the same answer.

Example 1 shows a more complicated AIML unit of knowledge, using URLs and a <srai> tag. The example shows both the code and how the question and response would appear in a chatbot window. In the example below different ways of asking for a tour can be keyed to one response. This example also includes a URL link which can open a preview at the bottom of the chatbot window. The patron can work within this preview window with the resources recommended; the preview pane can also be popped out into its browser window.

{Insert Example 1 and caption}

<category><pattern>VIRTUAL TOUR</pattern>

<template>The UCI Libraries are part of the largest public university library system in

the world. We are a world class provider of peerless digital and print collections and

research tools, but we are also your research partner. UCI Library staff are friendly,

welcoming, and here to help. <a href=" http://www.lib.uci.edu/about/visit/tour/virtual-

tour.html" target="_blank">These tours will help you explore your new home away

from home.</template></category>

   <category><pattern>VIRTUAL TOURS</pattern>

   <template><srai>VIRTUAL TOUR</srai></template></category>

   <category><pattern>SELF GUIDED TOUR</pattern>

   <template><srai>VIRTUAL TOUR</srai></template></category>

   <category><pattern>TOUR</pattern>

   <template><srai>VIRTUAL TOUR</srai></template></category>

   <category><pattern>TOUR OF THE LIBRARIES</pattern>

   <template><srai>VIRTUAL TOUR</srai></template></category>

Using example 1, we can also use symbolic reductions to increase the possibility that our recursion categories will be picked up. In this case we really care about the fact they are asking for a tour but not necessarily *how* they ask for a tour. We can use the symbol "*" as a wildcard to represent any of the *categories* above as "keyword," "* keyword," "keyword *," or "* keyword *." The category Virtual Tour would then be represented as "virtual tour," "* virtual tour," "virtual tour *," and "* virtual tour *." Using "*" means that a library patron can state: "virtual

tour," "I want a virtual tour," "virtual tour available," or "is there a virtual tour available," and all of these inputs would receive the correct response.

Using the tag <that> can allow you to connect categories together; this is particularly useful if the chatbot needs to ask the patron a question. In example 2 below let's envision that the patron entered the single word "policy." We don't know what kind of policy they might need. They could be looking for library policies or state, national, or international government policies. We can ask them the question, "Are you looking for library policies or policies for W39C?" When they respond to the question with either of the inputs "library" or "W39C" they receive different responses.

{Insert example 2 and caption}

<category><pattern>POLICY</pattern>

<template>Are you looking for library policies or policies for W39C?

</template></category>

<category><pattern>LIBRARY</pattern>

<that> Are you looking for library policies or policies for W39C_</that>

<template>All of the library policies are available on our policies

page.</template></category>

<category><pattern>W39C</pattern>

<that> Are you looking for library policies or policies for W39C_</that>

<template>Take a look at the Understand Policies and Find Policies tab on the

Writing 39C: Argument and Research LibGuide.</template></category>

Using the tags described above plus a couple of others allow the botmaster, another name for the *chatbot* creator, to direct patrons to the correct resource. For instance, if a patron simply

said, "I want more information on nursing assessment," we return a response asking them if they are looking for books or articles. We set the topic to books or articles depending on their response.

> <category><pattern>I WANT MORE INFORMATION ON *</pattern>
>
> <template><think><set name="topic">booksorarticles</set><set
>
> name="search"><star /></set></think>Did you want articles or books on <star />? Say:
>
> "articles" or "books".</template></category?

Typing that you want more information triggers the *booksorarticles* pickup line. Knowing if you want books or articles, combined with the "*" input, in this case, a subject or keyword, helps return the appropriate response. A *sourcetype* value of books triggers an ANTPAC catalog search using the "*" input. Stating that you want articles pulls from the second <li> in example 3 below, which returns 1-3 subject librarian recommendations. The first resource URL will open in the window below the chatbox; the second URL will be hyperlinked and can be opened in another window. In resource recommendations we also include a link to the subject guide, thereby linking them to more resources.

We also include a link to "Ask a Librarian," our reference assistance page, so patrons can seek further help if they are not finding the information they need. By pointing patrons towards resources and not running the search for them, we are subtly recommending resources that would be useful for their topic. With all of our LibGuides and database descriptions, library class evaluations indicate that students still do not know how to choose the best resources. If they remember that we have a Nursing LibGuide, it provides them with a model to find information in the future.

{Insert example 3 and caption}

<category><pattern>NURSING ASSESSMENT</pattern>

<template><condition name="sourcetype">

<li value="books"><antpac><get name="topic" /></antpac>.

We would recommend that you start your search with <a href="

http://uclibs.org/PID/106625" target="_blank">CINAHL and/or <a href="

http://uclibs.org/PID/17708" target="_blank">PubMed. For more resources check

out the <a href=" http://libguides.lib.uci.edu/content.php?pid=5567"

target="_blank">Nursing Libguide and if you are not finding what you need <a

href=" http://www.lib.uci.edu/services/ask/ask-a-librarian.html" target="_blank">Ask a

Librarian.
</condition></template></category>

The *booksorarticles sourcetype* requires that 68 AIML files work together. There is a total of 66

subject files that contain keywords and resource recommendations. In addition to the subject

files, the chatbots include a file called "chatbot.aiml" that comprises variations of how a patron

might ask for books, articles, or information. The last file deals with interactions where one

keyword might be included in multiple subjects. To deal with keyword interactions we had to

split the <li> for books and articles; see part A and part B in example 4 below. The interactions

file now contains the keywords that appear in multiple subjects; included is the *sourcetype* for

books so that an ANTPAC search can be run independent of the subject area. If someone

requests articles, they get a response that the given keyword appears in multiple subjects. The

patron is then asked to choose the subject for which they would like resource recommendations.

{insert example 4 and caption}

Part A: interactions file

<category><pattern>AIR ART</pattern>

<template><condition name="sourcetype">

<li value="books"><antpac><get name="topic" /></antpac>.

Air Art as a subject is included in the broader subjects of Art and Contemporary Art.

Would you like resource recommendations for art or contemporary art?

</condition></template></category>

Part b: subject file

<category><pattern>ART</pattern>

<that>Air Art as a subject is included in the broader subjects of Art and Contemporary

Art Would you like resource recommendations for art or contemporary art_</that>

<template>We would recommend that you start your search with <a href="

http://uclibs.org/PID/33002" target="_blank">Art Full Text and/or

Art

Bibliographies Modern. For more resources check out the

Art Research Libguide

and if you are not finding what you need

Ask

a Librarian.</template></category>

Using <that> in the subject file allows us to use the subject, in this case, art, in the

pattern. This allows us to provide different resources depending on the broader subject heading.

If we didn't use <that> to set the response to the question then there is a greater chance that a

different response would be substituted and the library patron could get a wrong answer to their

question.