

## MUKURTU: INFORMATION RETRIEVAL SYSTEM ENGINEERED FOR INDIGENOUS INDIVIDUALS AND COMMUNITIES

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### **Abstract:**

*This paper will examine the Mukurtu content management system (CMS) developed by researchers at Washington State University to address specific needs of Indigenous individuals and Indigenous communities worldwide. Mukurtu is based on the open-source DRUPAL platform and utilizes many aspects unique to that platform, such as role-based permission systems, which are utilized to construct the Traditional Knowledge Licensing hierarchy used in Mukurtu. Finally, a comparison between a tribal library's web portal located in Washington State that uses the Mukurtu format and one in the same area that utilizes the industry dominant CONTENTdm CMS is performed.*

**Keywords:** indigenous, communities, CMS, digital library, tribal museum

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### **Introduction**

The information retrieval system I will be addressing in this paper is known as Mukurtu. Mukurtu is a digital archiving system designed for use by the Warumangu aboriginal community in the Tennant Creek area of Australia (Lee & McConvell 2008). It is an XML based system that is built on the open access Drupal platform. (Lende 2011). This information retrieval system is built to operate as a digital archive with different goals than traditional archives and search engines. Mukurtu is designed, not to facilitate preservation and universal access to the information contained within the archive, but to respect the different social and cultural protocols of the community from which the information originated (Christen 2009, p. 5). Mukurtu allows the control of information access based on ways that are culturally congruent with the source community. Community roles such as kinship, status, etc. are built into the information access system in a way that properly categorizes the information contained in the database. This is done primarily through the use of traditional knowledge licenses (Lende 2011). Its co-creator and project director, Kim Christen, describes the needed features of the system as “variable user access, community-

focused metadata and search categories, user-generated comments and tags, restricted content based on [indigenous] protocols, and the ability to print, edit, and/or remix content for their own use.” (Christen 2008a, p. 21)

The overall goal of the Mukurtu information retrieval system is one of “creating a community archive... to leverage the technological functionality of search, database retrieval, and interface design to create a system built from [indigenous] protocols and knowledge systems.” (Christen 2008a, p. 21). The interface itself is problematic as some indigenous communities still exist with different types of intellectual and communicative literacy than the colonial Western culture would normally associate with the term. Often this precludes a literacy with an alphabetic written system or one in a language with wider usage. Due to the differences in communicative literacy the interface for a system like Mukurtu must be designed around a “visually driven interface [with] short paths to content.” (Christen 2008a, p. 21). The structure of the archive behind the interface must also be grounded in an architecture that is informed by “cultural protocols as the basis for both cataloguing the materials and for searching the database...” (Christen 2008a, p. 22).

## **Literature Review**

A review of the literature surrounding the Mukurtu project reveals the nuances of this issue. While open access is touted as being the new norm due to the prevalence of digital technologies, this is a specifically Western culture perspective on information. Indigenous communities have constructed vastly different parameters for information access over the thousands of years of their existence. Access, authority, and accountability from an indigenous perspective is rarely addressed in contemporary literature on open access of digital materials. This is not to say that archives and special collections are blind to the needs of indigenous communities. Many have signed MOUs or Memorandums of Understanding with indigenous communities in their region or communities whose cultural records are contained within their collections. (Christen 2008b). Anthropologists and other researchers sometimes do not address the needs of indigenous communities in this regard, although the past abuses of the academic community have lessened as education about indigenous issues continues. In the case of researchers it can often be tied to an absence of knowledge of cultural norms. With anthropologists, their professional code of ethics should point them to more ethical manners of dealing with the materials that they collect or generate in connection with indigenous communities (Christen 2009, p. 4). The information retrieval system, Mukurtu, was created to specifically address the information access and knowledge systems developed by the Warumangu aboriginal community. For this, and many other, indigenous communities, the digital record is not separated from the physical object and all the cultural taboos surrounding access of the object translates into the digital realm. To further define the specific issue, it is one of culturally relevant access to materials contained in archives that pertain to or are owned by indigenous communities. New digital technologies allow community members to access all manner of photographs, texts, linguistic data, field records (both audio and video), and religious teachings. This access allows communities to rebuild bridges to their historical culture (Hennessy 2009, p. 5), an especially important service for those that have been divorced from their culture through the actions of colonialism, ethnocide, and genocide. If digital repatriation and culturally relevant access of these materials is not implemented it could be considered a continuation of ethnocide by some communities, a label that most archives, special collections, and private custodians of the material would be none to happy to possess.

The struggle to create culturally relevant services to these communities is compounded by the rhetoric surrounding information freedom and open access to information. It creates an ethical quandary for many librarians and information scientists when restriction of access is required in order to be culturally sensitive. Many indigenous communities do not have access to physical archives or collections due to the physical distance between the communities where the cultural material is housed, language barriers, and, more often than not, abject poverty among the members of the indigenous community (Christen 2008b). Access then has to be facilitated via outreach and through a digital medium in order to best reach the community that requires it the most. Access to these archival materials and special collections should be developed while continually questioning the ethical mandate of open access to all information and understanding the huge facility for dissemination of this information in the digital age. Information retrieval systems need to be developed following rules established through specific “people-land-ancestor relationships...” (Christen 2009, p. 4). The ethics of digitization of others cultural heritage materials should be examined and re-examined throughout the process, as well as current intellectual property laws (Hennessy 2009, p. 5). If archivists, librarians, and information scientists approach the communities that the materials in question represent, the indigenous knowledge systems that facilitate access to the different materials are usually readily accessible (Christen 2009, p. 5). The systems of allowing material to be open for access, as well as being restricted, also need to be understood as they change with each individual and with the passage of time. These systems have been designed organically by indigenous communities in order to facilitate constant communication within the community. This model should be applied to the digital objects as well and should have the same effect. Through in-reach to the communities whose cultural capital is housed within a given collection, the librarian is able to engage in this process of constant communication (Christen 2009, p. 5). They are also able to directly engage with their own ideas surrounding the access of information and to understand it through a different cultural lens. The issue of outreach is directly coupled with the nature of digital objects as, even through repatriation of these objects, issues can arise due to the nature of digital records, which can be accessed and reproduced infinitely with no prior communication or consent from the indigenous community that lays claim to them. As has been mentioned, many barriers exist between communication between indigenous communities and the collections that house items of cultural capital important to them. Some of these barriers might not be lifted for the entirety of the community, nor would this be a desirable environment for some indigenous people. Internet access might be limited or non-existent and might not be desired due to the extreme assimilation effect access to the World Wide Web would have on isolated communities.

### **Indigenous Persons as a Distinct User Group**

The group to be analysed are those individuals of native/indigenous/aboriginal ancestry, more specifically, indigenous persons raised in an environment that still practices traditional lifeways. The user group being discussed extends to all indigenous persons as there are cultural characteristics that cannot be eliminated regardless of the amount of assimilation an indigenous individual or community is subjected to.

The content management system, Mukurtu, was initially designed to serve Aboriginal Australians as a user group but is now being adapted to serve indigenous user groups in North and Central America. The available literature on Mukurtu heavily favours the aboriginal Australian user group.

This user group maintains unique characteristics when we juxtaposition them against the Western culture, Anglo-Saxon, or white user group. The indigenous user group has been shown to favour information retrieval systems and educational software that contains interactive dialogic approaches where concepts are defined through their relationships to other objects. Additionally, if the system being used has clear ties to community interests and initiatives, this user group has been shown to be more motivated to interact with said system (McLoughlin & Oliver 1999).

Aboriginal Australians do not currently possess the same access to social mobility as the Western culture user group when it comes to being exposed to digital technology. In 2007 there were a recorded 8,000 Indigenous Australians enrolled in educational programs beyond high school, only 107 of those individuals are recorded as being in a program centring around information technology (Dyson, LE 2007, p. 2). Aboriginal Australians do not possess the same number of individuals that are already exposed to information technology as the Western culture user group and are therefore found in deficient numbers in these programs (Dyson, LE, 2007, p. 6).

Aboriginal Australians are socialized via different methods of learning, also. Typically, this group's traditional learning activities focuses on sharing, communication, community, and relatedness. Additionally, a strong sense of place helps to anchor their self-identification process. Any type of information retrieval system that is engineered to serve this user group needs to include these perspectives (McLoughlin & Oliver 1999).

Despite the lack of social mobility in the area of information technology, Aboriginal Australians are able to navigate a digital networked environment and manage and manipulate software that possesses strong visual and aural components more readily than the dominant culture or Western user group. They are more adept and learn faster in multi-media environments, whereas the Western culture user group is typically socialized to have strong skills in an alphabeticized or text-rich IR environment (Clemens, L, 2002).

### **Specific problem area for Indigenous persons in information retrieval**

One specific issue for the Aboriginal Australian user group is the user interface of an information retrieval system. Web-based information retrieval systems and open public access catalogues are, as a rule, text-rich digital environments. The alphabeticized environment is problematic for traditionally raised Aboriginal Australians as they possess different types of literacy than the Western culture user group.

There are difficulties in designing the user interface of an information retrieval system for this user group. For the purposes of this paper we have categorized Aboriginal Australians as one user group. The reality is that within this user group is a wealth of cultural diversity as well, linguistic, regional, etc. In order to design an IR system with a user interface that affects this user group in the most beneficial way, one must focus on the differences within the user group and the specific issues these differences create on the micro-cultural level (Bourges-Waldegg & Scrivener 1996, p. 316). A heterogeneous user group will require an interface designed with the relationships between the diverse individuals kept in mind (Bourges-Waldegg & Scrivener 1996, p. 317).

Any user interface that is designed for this user group needs to engage with their specific types of visual and aural literacy, which developed in a post-colonial environment and extends far back into pre-history. The development process should include members of this

user group as well, as suggestions regarding the diversity in understanding between age group, types of information most required by Indigenous persons, and outside references to community members that act as role models and mentors could greatly enhance the efficacy of the information retrieval system. The design of a user interface directly engaging this user group should also possess degrees of authenticity in expressions and representations of cultural symbols, iconography, etc. (Clemens, L 2002). Inclusion of a cultural dimension in the user interface better enables information seekers in the specific user group to maintain “a cognitive anchor for new knowledge and allows them to relate and integrate new concepts within a coherent perspective that recognizes diversity.” (McLoughlin C & Oliver, R 1999). Lack of interactivity has been shown to be detrimental to this user group in relationship to interaction with an information retrieval system. A strong graphical user interface (GUI), navigation features with a heavy concentration on icons, and graphical controls appeal to this user group’s culture, which has very strong and continuing traditions of transmission of complex ideas via paintings and carvings (Dyson, LE 2007, p. 7). When a specific user from this group has obtained a degree of alphabeticized literacy, then the most successful interface will be one that utilizes her native language. Those without the same degree of written literacy are able to maintain a high functionality when the audio components of the interface are in their native language as well (Barber & Badrew 1998, p. 4), although the aforementioned micro-cultural diversity can affect the success of the interface when regional dialects are taken into account (Barber & Badrew 1998, p. 9).

### **Discussions with development team of Mukurtu, regarding user interfaces**

Members of the development team of Mukurtu were kind enough to engage in communication surrounding the issue of user interface design for this user group, as well as the larger user group of native/indigenous/aboriginal individuals and communities worldwide, as service to this user group is the purpose for the development of the content management system. The results of this communication include points that can be used to engage the development process within a critical framework.

Zooy Kroll, the Creative Strategist & User Experience Designer at Civic Actions (<http://www.civicactions.com>) and former User Experience Designer for the Mukurtu project stated that “Community participation is essential to the project. The first online community gathering set a pattern for involving people in the development process. These types of forums will help shape the evolution of Mukurtu.” (personal communication, March 15, 2012) and offered a link to the ‘Online Community Gathering.’ The community referenced in the above communication, however, appeared to only represent the community of designers and developers and was not inclusive of the aforementioned user group or any persons from the larger Indigenous user group. Similarly, Kimberly Christen, Associate Professor in the Department of Critical Culture, Gender and Race Studies at Washington University, and founder of the Mukurtu project, had this to say regarding information on user experiences:

“Right now we are in full development mode and are working through several engineering sprints to get the full functionality of Mukurtu CMS operational at a .09 release by June 4. Subsequently we don’t have much data for you on user experience that we could pass on. However, the alpha version of Mukurtu was used as the backend for another project I direct called the Plateau Peoples’ Web Portal at <http://plateauportal.wsulibs.wsu.edu/html/ppp/index.php>” (personal communication, March 16<sup>th</sup>, 2012).

It should be noted that Mukurtu has progressed to release 1.1 as of Spring 2013.

The Mukurtu content management system was distributed to a ‘first-run’ user group that includes the Pueblo of Zuni, Zuni Public Library; Citizen Potawatomi Nation Cultural Heritage Center; Yakama Nation Library; and the original user group that initiated the Mukurtu project, the Warumungu, Nyinkka Nyunyu and Culture Centre. All four were contacted during the research for this paper, none of which, at the time of writing, have replied to the inquiries.

Research suggests that to solve issues surrounding engagement with the interface of an information retrieval system for Aboriginal Australians or Indigenous persons on the whole, said interface requires inclusion of community members during the design and development process, should typically be more graphically and aurally centred design to appeal to the user group’s differences in literacy types, and should speak to current and historical community issues.

### **System Analysis: Mukurtu**

The Mukurtu digital content management system has many unique system features we will concentrate on in this analysis. The system itself is based on the open-source content management system (CMS) Drupal. Utilizing this open-source CMS allows Mukurtu to easily perform some of its core functions, designed specifically for indigenous communities, that require the ability to carefully manage their cultural content once in a digital form.

### **Content Management Systems (CMS)**

A Content Management System allows archives, libraries, museums, etc. the ability to easily manage web content and both the static and dynamic aspect of their web portal. They allow for a webmaster to be part of the institution or a member of a third-party contracted to aid the institution (Farkas 2008, p. 36). Mukurtu, using the Drupal CMS framework, has made a commitment to both the communities it is designed to serve as well as the Drupal community of developers. Drupal has been billed as a tool that can create powerful communicative platforms for underserved populations, making a perfect fit for the Mukurtu project (Austin & Harris 2008g, p. 7).

We will begin with an analysis of the CMS framework underlying Mukurtu’s functionality, Drupal. One of the principle reasons that archives and libraries are created is in order to acquire, index, retrieve, and present content. A CMS or content management system, allows archives to perform this function. A CMS utilizes databases and modern web design language to store and define this content. The difference between a CMS and traditional web site is its ability to separate content from formatting. Using a CMS, content can be changed and managed without having to recode the entire site. CMSs create a framework for the creation, management, and publishing of content in a secure environment, adding the functionality of managed user roles (Austin & Harris 2008g, p. 5).

As has been mentioned, Drupal is an open-source CMS that has been released under a GNU General Public License. Any sites created using the Drupal CMS adhere to the same open-source license, including Mukurtu. Drupal runs under a ‘LAMP’ environment, where LAMP refers to the LINUX operating system, Apache web server, MySQL database, and PHP language (Austin & Harris 2008c, p. 8). The concept of content in Drupal is the same as that expressed by the term node. A node is defined as segments of information that typically consist of a title and a body and are stored as a single item within the CMS. A node is both

the stored information and the storage and reference structure. Nodes can be displayed by themselves or together with other similar nodes (Austin & Harris 2008a, p. 10).

## **Nodes**

In a Drupal based CMS, nodes are the only segments of information that can be extended, either by other nodes or other types of information. Different types of nodes are typically referred to as content types. Each content type is built from a title, body, and additional options. These options help enable more functionality that is engineered into what is referred to by the Drupal open-source community of developers as modules. Modules are coded to extend functionality for web sites developed using the Drupal CMS (Austin & Harris 2008d, p. 21). There are other segments of information within Drupal that cannot be directly manipulated in the same way as nodes. These include comments, taxonomies, menus, blocks, roles, and themes. These segments of information do, however, enjoy a symbiotic relationship with any nodes created (Austin & Harris 2008a, p. 11).

## **Comments**

Comments can be associated with any node. They are small bits of information that are linked to a specific node. There are also modules that have been developed to allow for searching within the information attached to comments. Comment modules also allow for limited moderation such as basic approval, deletion, and some minor editing ability (Austin & Harris 2008a, pp. 11-12).

## **Taxonomies**

Taxonomies can be integrated into nodes allowing for the attaching of controlled vocabularies and/or tagging. Controlled vocabularies can be mandatory or voluntary and can have single or multi-selectable fields. A system based on the Drupal CMS will automatically create a page for each individual term in a taxonomy and allow for grouping of these pages. Folk taxonomies can also be initiated through the use of separate modules developed by the Drupal community of developers, such as 'Tagadelic,' which create tag clouds from terms within an established taxonomy.

## **Menus**

Drupal CMSs allow for an advanced menu system that features navigation, security, and controlling the page display. Menus are managed as a hierarchical structure of links to pages internal to the site (Austin & Harris 2008a, p. 12).

## **Blocks**

The functionality of blocks can mimic that of nodes and they can hold information in the same manner as pages. The information stored within a block cannot be acted upon in the same way as that stored within a node. The purpose of blocks is to allow placement of information around a specific page based on predetermined block regions (Austin & Harris 2008a, p. 13).

## **Roles and Traditional Knowledge Licensing**

Many developers in the Drupal open-source community refer to it as a community management system, as opposed to a content management system. This is due to the functionality of roles within the system. Drupal CMSs utilize a role-based system that enables and disables permissions (Austin & Harris 2008f, p. 15). This function of the Drupal CMS allows for one of the core features of Mukurtu. The system of role-assignment allows for the use of Traditional Knowledge Licensing hierarchies, specific to Mukurtu. Traditional Knowledge fields are found along the standard Dublin Core metadata fields included in the Drupal CMS. They allow for the diversity inherent in Traditional Knowledge systems to be accommodated and not beholden to the essentially Western Dublin Core system of metadata classification. Individuals assigned specific roles have access to cultural content managed by the CMS based on these Traditional Knowledge Licenses. These licenses allow indigenous communities to create different levels of access, based on user roles. They also help to manage the digital cultural content available on the database, based on culturally relevant criteria. Mukurtu's use of the Traditional Knowledge (TK) licensing scheme also communicates to users of the database that there is sensitive material contained within that may not be appropriate for widespread dissemination. Mukurtu also allows for the cataloguing of content based on cultural protocols that managing what content is available to different users (Traditional knowledge licenses, 2011).

Also within the Drupal arsenal is the Content Construction Kit (CCK) module that extends Drupal's node system through the enabling of creation of custom types of content. This allows a user on the back-end, for instance, a tribal librarian, to create web forms that collect data that is deposited directly into the database. The implications of this function for research by an indigenous community is clear. The CCK also allows for the building of views, which dictate the display seen on the user end and any filters that can be applied based on the user's assigned role (Austin & Harris 2008e, pp. 23-24).

Indigenous communities often have very different creative processes than those based on the Western cultural model. This often means that the author is not a solitary figure (Burri 2010, p. 43). Mukurtu and its underlying content management system, Drupal, have created a system that functions well in a non-Western environment and empowers indigenous communities, allowing them to protect themselves from cultural appropriations, both intentional and unintentional, from the research community at large (Burri 2010, p. 45). The versatility and functionality described above is proving to be a powerful tool enabling researchers and the lay community culturally-relevant access to traditional knowledge system.

## **System Comparison between DRUPAL and CONTENTdm based CMS.**

We will now look at a comparison between the Mukurtu and CONTENTdm content management systems (CMS), as they are manifested in the web portals of two Pacific Northwest tribal entities. The Mukurtu based system to be used is the *Plateau Peoples Portal*, which houses digital archives for Coeur d'Alene, Colville, Spokane, Umatilla, and Yakama and can be found at <http://plateauportal.wsulibs.wsu.edu>. The comparison system, which uses the CONTENTdm CMS, is the web portal of the Jamestown S'Klallam Tribe and can be found at <http://www.tribalmuseum.jamestowntribe.org>.

Our comparison will consist of an examination of the features and functionality of CONTENTdm, a brief investigation into how these features support or hinder the indigenous

communities they serve, and a precision calculation for both systems using three base keywords that have immediate relevance to the source communities and should be reflected well in the data base of digital resources: ‘salmon,’ ‘fishing,’ and ‘hunting.’

CONTENTdm has been utilized by many organizations since it was engineered at the close of the twentieth-century (Broaddus & Hackbart-Dean 2009, p. 352). It was developed at the University of Washington by Craig Yanashita, Lawrence Yapp, Joe Tavares, Geri Ingram, and Jill Fluvogi, among others. In 2001 the project was given over to a third party company by the name of DiMeMa, who in turn partnered with OCLC (Online Computer Library Center) in 2002. By 2006, over 300 libraries had joined its user base (Zick 2009, p. 690).

CONTENTdm is very much an industry standard CMS. It supports “Dublin Core, JPEG2000, OAI (Open Archive Initiative), Harvesting, PHP (Hypertext Pre-processor), and API (Application Programming Interface)” (Zick 2009, p. 691, Higgins 2012, pp. 8), all standards known to be used by information professionals. It allows for the content management of digital resources using ready-made ‘out-of-the-box’ functionality as well as supporting some customization (Higgins 2012, pp. 7-8).

Metadata supported by CONTENTdm includes what is known as the DC-15, which refer to content, intellectual property data, and metadata resource creation; Title, Subject, Description, Type, Source, Relation, Coverage, Creator, Publisher, Contributor, Rights, Date, Format, Identifier, Language (Higgins 2012, p. 8).

Other features include a built-in PDF OCR (Optical Character Recognition) for scans of contextual resources (Broaddus & Hackbart-Dean 2009, p. 354), the ability to manage collections remotely in an online environment (Zick 2009, p. 692), full compatibility with the Unicode standard of font development, and the facilitation of “discovery of items in special collections through WorldCat. Metadata for collections can be added to WorldCat to make digital items more visible to searchers...” (Zick 2009, p. 692-693).

Some of the possible drawbacks to the CONTENTdm CMS are that new collections must be created on the server side via a password protected account, image file formats must conform to the specifications of the CMS, and approval of any cataloguing efforts performed on a collection must be approved by an administrator on the back-end before it can be indexed. The automated indexing process also allows it to be searched and viewed via WorldCat (Higgins 2012, p. 10).

The above items might not seem at first glance to be drawbacks, but more along the lines of increased functionality of the system. While this might be true if the CMS is to be utilized by an academic library or other research institution, the needs and desires of communities of indigenous persons operating a digital repository will likely vary considerably from those of these types of institutions.

A content management system using the DRUPAL based Mukurtu platform will be engineered with the specific needs of indigenous communities in mind. These communities might not have the desire to leave their cultural capital in the hands of an administrator on the server-side of the relationship. Even if the community houses its own server, the desire for a more collaborative environment and greater flexibility in the assignation of permissions might be desired. The general audience for resources that are managed by a CONTENTdm-based system are likely to be “The general user [who] does not need as much information as the curator.” (Cospers 2007, p. 55), whereas those who seek out a system using a Mukurtu-

style interface using the DRUPAL CMS will have more specialized or culture-specific interests. The interface with WorldCat might also cause issue with indigenous communities who, historically, have lost enormous amounts of potential resources due to their culture-specific knowledge being appropriate by a wide spectrum of the general public, not to mention the inadvertent ethnocide that misappropriation of this knowledge entails.

Looking at both digital archives in more detail, we see how both systems allow for minimal user effort in the accessing of their resources. The Plateau People's Portal (PPP) requires a potential user to establish a username, password, and profile, where the 'House of Seven Generations' portal of the Jamestown S'Klallam Tribe (H7G) does not require this formality. The requirement of the user to establish a profile to use the Plateau People's Portal is necessitated by the increased control that the Mukurtu-based portal affords the indigenous communities who established the digital resource. The House of Seven Generations portal, on the other hand, being managed by the CONTENTdm system, affords access to a greater percentage of the public, allowing for less granular control by the resource's community. The Plateau People's Portal has a slightly longer route to the point of access than the House of Seven Generations portal, but once a user profile is established, the distance is closed.

Judgments on resource relevance were made by the author who possesses a somewhat greater degree of knowledge of American Indian culture, history, and language than the lay person through a number of years of academic research and a marginal embeddedness in the urban American Indian community of Milwaukee, WI through language study of Ojibwe at the Congregation of the Great Spirit located at 1000 West Lapham St., Milwaukee, WI.

Beginning the precision analysis, the search field at the top right of the first page arrived at after log-in on the Plateau People's Portal was utilized to enter three basic keywords (salmon, fishing, hunting) entered in succession.

Where PPP = Plateau People's Portal, P = Precision, and RR = Relative Recall;

PPP: Salmon

<http://plateauportal.wsulibs.wsu.edu/html/ppp/search.php?sq=Salmon>

$P = 14/14 = 1.00 = 100\%$

PPP: Fishing

<http://plateauportal.wsulibs.wsu.edu/html/ppp/search.php?sq=Fishing&pgst=0>

$P = 20/40 = 0.50 = 50\%$

PPP: Hunting

<http://plateauportal.wsulibs.wsu.edu/html/ppp/search.php?sq=Hunting>

$P = 7/26 = 0.27 = 27\%$

The same three keywords were utilized in the 'search all online collections' field located in the middle right of the second page accessed after choosing any of the four format-specific category buttons (Photo, Artifact, Document, and Media) on the front page of the House of Seven Generations portal.

Where H7G = House of Seven Generations;

H7G: Salmon

<http://www.tribalmuseum.jamestowntribe.org/cdm4/results.php?CISOOP1=any&CISOBOX1=Salmon&CISOFIELD1=CISOSEARCHALL&CISOROOT=all>

$$P = 10/20 = 0.50 = 50\%$$

H7G: Fishing

<http://www.tribalmuseum.jamestowntribe.org/cdm4/results.php?CISOOP1=any&CISOBOX1=Fishing&CISOFIELD1=CISOSEARCHALL&CISOROOT=all>

$$P = 38/42 = 0.90 = 90\%$$

H7G: Hunting

<http://www.tribalmuseum.jamestowntribe.org/cdm4/results.php?CISOOP1=any&CISOBOX1=Hunting&CISOFIELD1=CISOSEARCHALL&CISOROOT=all>

$$P = 34/38 = 0.89 = 89\%$$

The arithmetic mean of the above percentages produced the following results;

PPP

$$P = 1.77/3.00 = 0.59 = 59\%$$

H7G

$$P = 2.29/3.00 = 0.76 = 76\%$$

## Conclusion

It is shown in the precision calculations that the digital resource utilizing the CONTENTdm CMS produces more favorable results for both precision and relative recall. The Mukurtu portal based on the DRUPAL CMS, however, is engineered to more specifically serve the source indigenous community. The lower precision and relative recall percentages for the Plateau People's Portal could be due to the wider, and less industry specific, cataloguing methods used by its CMS, where the CONTENTdm based CMS is engineered towards industry standards, therefore producing more favourable results when an industry method of analysis is applied.

Both portals were chosen as the preferred model by their source communities. Where the Plateau People's Portal is engineered to serve the specific cultural needs of the indigenous communities whose digital resources it houses, the portal is maintained by the University of Washington – a Western culture institution. The House of Seven Generations portal, however, is owned and operated by the Jamestown S'Klallam Tribe and is maintained by tribal members or their chosen affiliates. Both systems show their own benefits and a clear demarcation between which system is better cannot be determined. It could be intuited that

the poorer score on the precision measure for the Mukurtu-based CMS is a sign that its design is clearly the winner in regards to cultural relevance to the predetermined user group.

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