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Kiva Construction: Tracking Indigenous Techniques Using Article Indexing and Classification—Research in Progress

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Abstract

As research continues in the development of techniques to discover research by and about Indigenous People, this paper is focused on the classification systems and controlled/uncontrolled vocabulary used to index an ancient building type in Arizona and the Southwest. Starting with the articles found in Compendex and Inspec, the search was expanded to several engineering digital libraries and then compared to the indexing of these same articles in the social sciences and humanities databases using ProQuest and EBSCOhost platforms. By analyzing these indexed fields across disciplines, the goal is to focus on improving indexing terminology as Tribes develop or improve the thesauri and classifications systems in their own languages. While these structures are not specific to the O'odham Peoples, the indexing of these articles will inform the creation of an O'odham thesaurus and classification systems currently under investigation and development at Arizona State University.

> kiva, n.
>
> A chamber, built wholly or partly underground, used by the Pueblo men for religious rites, etc.; estufa, n. Also attributive and transferred. [1]

Introduction

Engineers always want to know how something works. If that means taking it apart to reverse engineer it, they are quite happy to do that. They are also always looking to make improvements and have a whole list of "what if…?" for every one of them. This is especially true when they encounter an unknown structure from another civilization or lost arts of Western European colonial cultures. With little documentation available, they need to explore and mentally reconstruct. Efforts are still being made to perfectly match the colors and techniques lost to the ages for medieval stained glass and the paint of certain artists. Even though we might have the recipes, old recipes often are a list of ingredients with imprecise measurements without much guidance on combining techniques. Also missing are the source locations of ingredients and other materials [2].

We lost that information not only because this information was a trade or guild secret, but also because the oral and hands-on nature of the techniques were not passed on at some point. In a colonial culture so tied to written works rather than oral tradition, if it wasn't written down, it wasn't important. This is what Indigenous Cultures all over the world face. Knowledge, including sources for materials and techniques, are passed down orally. Additionally, the Indigenous Peoples even though they are oral cultures, they also have what Western European culture calls "trade secrets" or proprietary information. This proprietary knowledge is only shared with those designated within the Tribe to know the information. Part of the challenge

facing all storage and retrieval sources is to have a way to index proprietary information with public terms to make it discoverable and available to those allowed to know.

Currently, with efforts to revive ancient knowledge, it is helpful to find what we know has been written about the specific engineering projects of the past. Most of this literature is written from the colonial point of view, but it is a starting point. This is also a method to inform how to improve the indexing, metadata, and abstracting of the works of the Indigenous Peoples, who are now writing down some of their ancient knowledge to ensure it is not lost. Trade secrets will continue to remain proprietary, but we have to be able to find the public information on the topic.

How we organize our shopping systems both in stores and to a lesser extent online illustrates the point. Stores are arranged in groupings of similar items. Once you get to the group section, you then can get more specific. Likewise, library and archive indexing tend to use the most specific generic term. To use an engineering/construction example, fasteners is the term which covers nails, screws, pegs, and other devices to hold things together, but you can still find the individual items. This double indexing is wise since we use those individual terms, nail, screw, and peg, in other contexts to mean very different things, which can increase the false drops in an online search. This indexing method can also fail us when searching for documents. While the paper may focus on a specific engineering technique or device, it still needs to be included in the broader areas to keep it discoverable in a more general way when specific narrower terms are unknowable.

One way to research the discoverability of Indigenous Knowledge is to research topics with limited terms. This is why kivas were chosen as the research topic. Even after investigation, we have not found any other recent public terms for the structures called kivas. This simplifies the searching because there are very few words used for this structure. Pit structures, pit buildings, and pit houses or "pithouses" are indeed similar, but the size of the kivas required different construction. These terms were tried but in engineering these keywords more often related to any underground construction such as subways and other tunnels.

The term "kiva" is in the Oxford English Dictionary (OED) [1] citing quotes as early as 1871. OED does attribute the origins of the word to Indigenous languages of the Americas. "Kiva" was verified as an archaeological term with specific meanings [3]. While "estufa," a much older term from about 1844, could be used, its meaning in English is any underground chamber that has a fire burning [4]. It is also the Spanish word for stove, not a useful meaning for this project. In the database search engine, Engineering Village, no desired articles were discovered using the term "estufas," when modified by the Indigenous People terms. This indicates the term was likely no longer a widely used engineering term for the structure by the time Inspec and Compendex databases started indexing the articles going back to the 1880s. The search continues for any other specific Indigenous terms that might be better for indexing.

Setting aside the issue of full text document searching used for text mining which calls for different searching techniques, this raises the challenge of the best way to index and abstract documents to make them discoverable. This is the case with looking for engineering related articles on kivas, a structure used by the Ancient Puebloan culture in the American Southwest,

including Arizona. Kivas have been identified by Western European culture's archaeologists and astronomers as a calendar (site orientation), religious ceremonies, and community gathering places [5], [6], [7] based on the literature found. Kivas are also used by the Hopi and Zuni Peoples, who are some of the descendants of the Ancient Puebloans. While these Tribal name terms were tried, they more often were for the modern kiva rather than the kivas of interest which are truly from the Ancient Puebloan Culture.

Literature Review

This research is not developing in a vacuum. Both Thomas articles [8], [9] on inclusive language are still helpful. Matoya and Littlefield [10] continue to remind us of the perceptual differences and approaches to information between the Indigenous Peoples and the colonial culture. Indigenous librarians and archivists are working to develop indexing and metadata for their collections that are relevant to their communities and still useful for nonmember researchers. Especially noted is the Ewing [11] discussion of the limitation of the Library of Congress historical approaches to subject headings along with Farnel's discussion of metadata use in Indigenous Archives [12].

Decolonizing methodology is also in the forefront of librarians' minds [13] as consideration is given to how these terms impact which Indigenous word used for which engineering concept. With the challenges faced by Indigenous Communities as they confront the cultural bias implicit in colonial based research, the cautions, observations, and knowledge discussed by Ruckstuhl [14] provide guidance. The local Arizona Tribes are especially sensitive to this use and organization of their Tribal Knowledge and documents to suit colonial purposes.

This paper is in support of the local Tribes working to organize their Tribal archives and other collections. Arizona State University has multiple Tribal members doing important research guided by their Culture, so it is important to translate the indexing and metadata into appropriate subject terms in their own language; yet still have links to the applications, as appropriate, to the dominant culture. The approach to this issue includes trying to enhance the colonial indexing methods and terminology to morph into a new perspective of how to augment the indexing of technical scholarly writing to allow the Indigenous Collections to be more discoverable for authorized users.

Methodology & Results

Engineering-related Databases Explored

In designing the methodology for this research, the differences to be considered were between advanced search engines that allow PROXIMITY commands using the WITH, NEAR, PRE and EXACT commands as found in Engineering Village, ProQuest, EBSCOhost, and Scopus and to the digital libraries of the majority of the professional physics and engineering associations, which use basic Google search command structure. These associations' digital libraries rely on the common Google search engine for searching. While IEEE Xplore and ACM Digital Library have made some modifications for longer searches with varying commands, only IEEE Xplore allows two proximity search commands: NEAR, no specific order of the words, and ONEAR,

specified order of the words, for word proximity searching beyond the double quote (“ ”) loose phrase. While many think the double quote (“ ”) phrase is an exact phrase search, the algorithm for this is not exact since the space can be any character including a period and the start of a new sentence. Most results will be the desired phrase but there can be surprises.

With that in mind, the Kiva of the Ancient Puebloans is an edifice that has only this one word to describe the pit structure of that time period as shown in the OED [1]. While “estufa” [4] was researched, with a Spanish origin and use as the English word “stove”, it was discarded as a viable term for this research in predominantly English language databases.

Earlier research into finding articles about Indigenous Peoples [15] did show how a people related term needed to be added to identify a people rather than the same colonial word used as a place name or other use. To get more on the Ancient Puebloans’ construction techniques about kivas, the decision was made to use “Puebloan” as a single word rather than try any word phrases. This would be paired with the no longer acceptable term “Anasazi” [16] to be thorough since it was used extensively in the older literature.

The search strategy chosen to meet simple Google search criteria:

Kiva AND (Anasazi OR Puebloan)

Following the earlier recommendations [15], the searches would be limited to just the Subject/Title/Abstract instead of the default All Fields. This would eliminate the majority of false drops with other uses of the search terms.

Testing in Engineering Village (Inspec & Compendex) [15] showed only eight citations about these structures. Based on prior experiences, the autostemming feature that autostems words to the root word, was also turned off to avoid any truncation of the word “Puebloan” to “pueblo”. Upon examination, three of the citations were the three parts of one conference hosted by two associations in Compendex:

American Solar Energy Society (ASES) - Solar 2006:
35th ASES Annual Conf.,
31st ASES National Passive Solar Conf.,
1st ASES Policy and Marketing Conf.,
ASME Solar Energy Division Int. Solar Energy Conference, [17].

The abstract of the conference included a presentation on the ventilation of a specific kiva. Conference proceedings do not get keyword indexing; they only have the title and abstract. This lack of indexing for conferences is common in the databases searched across the chosen vendor platforms. The lack of indexing does impact the analysis of the subject terms and classifications assigned. There were also two citations to what appears to be the same presented paper on the ventilation of kivas published in the proceedings of two of the sponsoring associations of the conference. Both of these citations were indexed in Compendex, which relies on AI assisted indexing. The indexing of these two records are not identical (see Table I and II) although there are some similarities. Had the search been for specific engineering terms, both of these citations

to the same article could have been missed if the search did not include a heating or ventilation term or code.

TABLE I
ASME International Solar Conference Proceedings

Main Heading	Controlled Subject	Uncontrolled	Classification
Ventilation	Air conditioning	Air chamber	804.2 Inorganic Compounds
	Air pollution control	Air temperatures	731.3 Specific Variables Control
	Architectural design	Pollutants	643.5 Ventilation
	Carbon dioxide	Thermal comforts	921 Mathematics
	Mathematical models		643.3 Air Conditioning
	Temperature control		408.1 Structural Design, General
			402 Buildings and Towers
			451.2 Air Pollution Control

TABLE II
American Solar Energy Society - Solar 2006: 35th ASES Annual Conf., 31st ASES National Passive Solar Conf., 1st ASES Policy and Marketing Conf., ASME Solar Energy Division Int. Solar Energy Conference [18]

Main Heading	Controlled Subject	Uncontrolled	Classification
Thermal comfort	Carbon Dioxide	Air chambers	643 Space Heating, Ventilation and Air Conditioning
	Ventilation	Air temperatures	643.5 Ventilation
		Displacement ventilation	804.2 Inorganic Compounds
		Mean radiant temperature	
		Natural Ventilation	
		Small fire	
		Source of energy	

That left three other unique articles. The article that looked the least relevant to the kiva construction itself was on using ground penetrating radar to find tunnels under the kiva site [20]. However, tunnels or air shafts are critical to the ventilation of underground spaces. One article covered the domed roof of the pit kivas [20] with the two interesting construction techniques used during the Ancient Puebloan time period. The last citation was a proceeding [5] which included a paper on the alignment or orientation of the kiva to the sky [22]. Tracing the

bibliographies of these articles does lead to more articles, mostly written from a colonial perspective.

Next, these five citations were checked for cited references in Google Scholar to see if there are newer articles on the construction of kivas. Only four of the five were discoverable. One of the Sharag-Eldin and Dalton citations was not found. Two of these four have not been cited in the years since they were published (Table III). Those citing the Aveni proceedings were not all specific to the kiva but were on archaeoastronomy in the "new world."

TABLE III
ENGENEERING VILLAGE CITATIONS
WITH GOOGLE CITED BY

Sharag-Eldin, A & Dalton JL 2006	2
Guerro, Slota, Schmidt, & Waggel	0
Salvadori	0
Aveni	61

When using this search in the other science and engineering related databases (see Table IV), choices had to be made. In addition to Scopus and several government databases, only digital libraries of professional associations were searched, in part because as engineering students and faculty often tell us themselves, they typically search their own specialized engineering digital library and ignore others, except maybe Google Scholar.

TABLE IV

DATABASES SEARCHED WITH RESULTS

DATABASE	SEARCH STRATEGIES Results							
	Index terms available ?	A	B	C	D	E	F	any EV 8* articles ?
ACM Digital Library	Y	1	0	1	2	0	0	0
AIMS (American Institute of Mathematical Sciences)	N	0	0	0	0	0	0	0
AIP (American Institue of Physics)	Y	4	2	0	0	35	1	1
AMS (American Mathmatical Society)$^{+}$	N	0	0	0	0	0	0	0
APS (American Physical Society)	Y	0	0	0	0	0	0	0
ArXiv.org	N	0	0	0	0	0	0	0
ASCE Library	N	1	1	1	0	0	0	0
ASME Online Journals	N	0	0	0	0	0	0	0
Astrophysics Data System (ADS)	N	4	3	1	8	4	1	2
CAS SciFinder	N	0	0	0	3	0	0	0

EBSCOhost	Y	93	120	28	286	10	2	0
ECS/IOP (Institute of Physics)	N	2	2	0	2	0	0	0
IEEE Xplore	Y	0	0	0	0	0	0	0
Informs PubsOnLine	Y	0	0	0	0	0	0	0
LOCUS (SIAM archive)	Y	0	0	0	0	0	0	0
MathSciNet	Y	0	0	0	0	0	0	0
NTIS[++]	Y	1022	202	124	1022	27	6	0
Optica (OSA Publishing)	Y	0	0	0	0	0	0	0
ProQuest	Y	24	14	10	84	3	0	0
SAE Mobilus	Y	0	0	0	0	0	0	0
SciTech Connect (OSTI)	Y	6	37	9	0	8	0	0
SciX (NASA Science Explorer) BETA	N	4	3	1	8	4	1	1
Scopus	Y	34	25	10	98	3	1	6
SIAM	Y	0	0	0	0	0	0	0
SPIE Digital Library	Y	0	0	0	1	0	0	0
zbMathOpen	Y	0	0	0	0	0	0	0

Search Strategies:
A = kiva AND (Anasazi OR Puebloan)
B = kiva AND Anasazi
C = kiva AND Puebloan
D = (kivas OR kiva) AND (Anasazi OR Puebloan OR "Pueblo People" OR "Pueblo Culture" OR Pueblos OR "Pueblo Indians" or "Chacoan Culture" OR "Chaco Canyon")
E = archaeoastronomy AND (kiva OR Anasazi OR Puebloan) F = archaeoastronomy and kiva

* The 8 citations found in Engineering Village

[+]AMS selected from large list w/many false drop kiva uses

[++]NITS Tech reports -- Download by doc no cites list

The search used for Engineering Village needed to be modified for engineering association databases. These digital library search engines primarily use basic Google searching, which is simple keywords and only the double quotes (“ ”) available for phrases. The advanced search would also only allow for a single field search at a time. Without a specific field search, the search defaults to search the entire record. For more complicated searches, using this strategy would require multiple searches without a method to combine searches into one unified list. Specific field searching is a way to avoid searching the full text of the documents included in a digital library. Field searching also reduces the chance that the search terms are not connected or used in other contexts.

Several of the databases did allow the search string as used in Engineering Village but it searched in all fields. Others required that we break the search into just two concepts. Notice the space counts as an implied AND command in the Google search engine.

Kiva Anasazi

Kiva Puebloan

Once again, other uses of both the term “kiva” and of “Anasazi” were discovered. Some of them are

Kiva

- the name of a device to measure engine combustion dynamics [23],
- an anti-bullying program [24],
- a microfinance method [25],
- a journal name [26], and
- an author last name [27].

Anasazi

- a framework for eigensolvers [28],
- a role-playing game based on the Long House at Mesa Verde, Colorado [29], and
- an author first name [30].

Pueblo could not be used by itself since it is a place name used frequently in the Southwest. That is a reason to limit to the article title, abstract and subject terms (keywords). This avoids place names in author affiliations or granting agencies. Nevertheless, it showed up frequently in the abstract or title as a place rather than being about the Pueblo People or Pueblo Culture.

Social Sciences and Humanities Databases

These low database results were the basis for using the EBSCOhost and ProQuest platforms, which at Arizona State University, are primarily social sciences and humanities databases. Kivas are a frequent topic in archaeology and anthropology. The point here was to illustrate the indexing differences between the social sciences and humanities compared to STEM and engineering databases. It was also used to find additional potential terms.

Since ProQuest automatically searches the full text of articles, we used the TIABSU command (TItle, ABstract, SUbject) to limit to the article title, abstract, and subject/keyword terms to match the Engineering Village search more closely.

TIABSU(kiva AND (Anasazi OR Puebloan))

The majority of the citations were actually dissertations, which given the paucity of their keyword indexing reduced the utility for finding other possible indexing terms. The same search with the NOFT command (NO Full Text) instead of the TIABSU command did return more non-dissertations, but the newspaper articles and the two magazines had very little indexing. All except four articles of the scholarly journal articles were from the journal, *KIVA*. Some of those articles were certainly on our desired culture, but not necessarily on the kiva structure itself.

For EBSCOhost, the search had to be modified again to approximate the article title, abstract, and subject terms:

(TI kiva OR AB kiva OR SU kiva) AND (TI (Anasazi OR Puebloan) OR AB (Anasazi OR Puebloan) OR SU (Anasazi OR Puebloan))

The most articles we retrieved that were about the kiva as a structure in the Ancient Puebloan Culture were in EBSCOhost. Interestingly, the indexing here was for kivas (plural) and primarily Pueblo Peoples or Pueblo Culture with a few Pueblo Indians. Puebloan tended to be in the title or abstract and often paired with a culture or people term. Even more frequent was the use of a place name where kivas are located. While Chaco Canyon was used most, it was also likely that an individual kiva location within Chaco Canyon was named. For the Mesa Verde kivas, it was more likely to mention the Mesa Verde National Park as the location.

There were high hopes for Scopus when the article title, abstract and keyword search returned thirty-four articles. Unfortunately, the keyword indexing is only what is author supplied or came already indexed as those same articles we found from Compendex are. The results were primarily from search term matches in the article title or abstract rather than the indexing terms.

Indexing terms

To understand the indexing more thoroughly the downloaded indexing fields were placed in their own spreadsheet. Any indexing hierarchy was removed to make individual search terms. Classification codes were left as aggregated terms. The list was sorted and a word cloud created.

Fig. 1. Word cloud of subject keywords and classification codes found indexed in databases

As you can see, specific locations such as Chaco Canyon figure prominently as do other place names like North America; United States; New Mexico, the actual location of Chaco Canyon; and Colorado, where Mesa Verde National Park cliff dwellings are. It should be noted that these larger sites, like Chaco Canyon, have multiple "village" pueblo groups. Chaco Canyon has more than one kiva site, with each kiva typically named by the pueblo group's physical location.

Notice that the engineering and construction related terms are almost all in the tiny printed words.

This word cloud underscores the need for both precise and general indexing. The social sciences article indexing does include astronomy, architecture, general building types (stone, religious, ceremonial) along with the specific structure being investigated.

Examining Classification Codes

Classification codes are a mainstay of indexing organizational structure in a "tree" or taxonomic form, typically using numeric or alphanumeric ordering. To maximize searchability, classification codes need to be searchable by shorter codes rather than just the entire code. Compendex, for example, uses a three digit with one decimal structure for their codes. For this type of searching, having classification codes that are searchable using less than the full code is helpful. An example of a better organized code is the North American Industry Classification System (NAICS) code [30], which can be searched by one, two, three, four, five, or all six digits. This segments the industry into smaller more manageable sizes as useful ways for research in combinations that make sense in business. This is helpful when tracking industries in NAICS that might straddle more than one code depending on definition. Thus, by extension, when unsure of which classification code would be used, searching by the parent code in a hierarchy and getting all subcodes reduces typographical errors and improves readability of the search strategy. This can be done in EBSCOhost, ProQuest, and PubMed/Medline with the EXPLODE command available for the thesauri, but not with the classification codes. Classification codes can also reduce the keywords needed for a search or focus to a specific segment.

For example, to find all heating, cooling or ventilation articles on kivas, the search must include these Compendex codes:

640 Series-HEAT AND THERMODYNAMICS
641-Heat and Mass Transfer; Thermodynamics (Compendex)
641.1-Thermodynamics (Compendex)
641.2-Heat Transfer (Compendex)
641.3-Mass Transfer (Compendex)
642-Industrial Furnaces and Process Heating (Compendex)
642.1-Process Heating (Compendex)
642.2-Industrial Furnaces and Components (Compendex)
643-Space Heating, Ventilation and Air Conditioning (Compendex)
643.1-Space Heating (Compendex)
643.2-Space Heating Equipment and Components (Compendex)
643.3-Air Conditioning (Compendex)
643.4-Air Conditioning Equipment and Components (Compendex)
643.5-Ventilation

The EXPERT search using these is:

> ((((kiva OR kivas) AND (Anasazi OR Puebloan OR "Pueblo Culture" OR "Pueblo People" OR "Pueblo Indians" OR pueblos OR "Chacoan Culture" OR "Chaco Canyon") WN KY) AND ((({640}) WN CL) OR (({641}) WN CL) OR (({641.1}) WN CL) OR (({641.2}) WN CL) OR (({641.3}) WN CL) OR (({642}) WN CL) OR (({642.1}) WN CL) OR (({642.2}) WN CL) OR (({643}) WN CL) OR (({643.1}) WN CL) OR (({643.2}) WN CL) OR (({643.3}) WN CL) OR (({643.4}) WN CL))))

Even with the expanded keywords search, this search finds only the two Sharag-Eldin [18], [19] citations and no other articles.

The more expansive keywords and the classification codes found in the Engineering Village results would look like this:

> ((((kiva OR kivas) AND (Anasazi OR Puebloan OR "Pueblo Culture" OR "Pueblo People" OR "Pueblo Indians" OR pueblos OR "Chacoan Culture" OR "Chaco Canyon") WN KY) AND ((({400}) WN CL) OR (({402}) WN CL) OR (({402.2}) WN CL) OR (({405.2}) WN CL) OR (({408}) WN CL) OR (({408.1}) WN CL) OR (({408.2}) WN CL) OR (({409}) WN CL) OR (({414}) WN CL) OR (({414.3}) WN CL) OR (({415.3}) WN CL) OR (({451}) WN CL) OR (({451.2}) WN CL) OR (({454}) WN CL) OR (({454.1}) WN CL) OR (({480}) WN CL) OR (({481.1}) WN CL) OR (({481.3.1}) WN CL) OR (({900}) WN CL))))

This search also discovers just three of the four citations. It finds only one of the ventilation citations [18]. This code search does not find the archaeoastronomy citation [5] because that citation was from Inspec. The classification searches used Compendex classification codes, which are different than those used in Inspec.

Since proceedings as a collective entry do not get any code except one for proceedings, Conferences are unlikely to be found using construction related classification codes rather than just keywords. If individual papers from the conference are indexed, then conferences are found indirectly using classification codes.

Analysis & Discussion

This does not mean that there are no other engineering articles. It means that articles are written less with an engineering point of view or terminology and more with historical, cultural, or archaeological points of view. This also suggests that they are not published by the engineering societies or in journals indexed by engineering databases.

Astronomy is generally not an engineering field except when it comes to the location, construction, and orientations of astronomical structures. None of the codes used in the searches above specifically included orientation or siting. Because this citation is to a conference proceeding, the only classification code other than the proceedings code assigned to the archaeoastronomy article was

> A9590 Other topics in astronomy and astrophysics.

Since this conference proceedings had the words “Anasazi kiva” in the abstract, the original search found the citation; but Engineering Village did not index the individual articles of those proceedings. Google scholar did index the “Anasazi Kiva” article [22] which provided links to fourteen newer “cited by” articles. EBSCOhost also indexed this article.

To add to the understanding of the research and indexing, variations of the searches with the term archaeoastronomy or archeoastronomy were used. However, to find more relevant articles the search had to be expanded to an OR search with kiva, Anaszi, or Puebloan for better results. While the colonial-based kiva research in astronomy has confirmed the siting or orientation nature of the building [5], [6], [7], fewer of the articles were about the kivas themselves than other aspects such as the art, niches, and placement, but the indexing terms did expand our word cloud results.

Using Google searching

Looking at the search results, the impact of Google search engine’s hidden algorithms and AI are more insidious than ever. Bevendorff, J., Wiegmann, M., Potthast, M., & Stein, B [32] do provide strong evidence of continuing manipulation of algorithms and hidden query parsers in our search engines. This is not likely to abate soon. As artificial intelligence becomes more mainstream, we searchers are likely to face even stronger challenges of misinterpreted searches or assumptions of what we want. We are still faced with what we don’t control in a search engine:

a) When the entire record is searched, too many false drops occur. When possible use the field searching options of Article Title, Abstract, and Keyword (controlled & uncontrolled vocabulary)

    1) Without field designators, the search is for the entire record
    2) The entire record includes hidden metadata
    3) May include full text available in the database

b) Hidden algorithms are not always obvious until you see your results

    1) Query parsers (algorithms) may reinterpret your commands
    2) May keep track of previous searches and place those related results higher a la Google browser search.

Conclusions

Choosing such a defined structure as a kiva to research was a boon and a bane. While it focused the research (boon) and highlighted the challenges (bane), it was researching a very narrow area. The biggest advantage was the specificity of both “kiva” and “Anasazi”. This was also the drawback in terms of engineering. Both terms have other meanings and uses in engineering. Those uses and their contexts made it time consuming to pick out the ones that were specifically the desired use of these terms. As “Anasazi” becomes less used in recent scholarly articles, this issue should disappear except for the older literature. “Kiva” will continue to be a challenge to

research on any aspect of the engineering of the structure until articles are better indexed for general terms and the highly specific ones.

As the databases currently exist, the search should have returned articles on any aspect of this structure in any engineering context. However, this is not the case. When the article title and abstract are more useful than the indexing and classification system, this indicates a tendency to index only to the highly specific. The fact that citation tracing does lead to more articles on the topic, further highlights the insufficient indexing terminology and classifications. Since the majority of the articles are not by Native Authors, it does suggest that as Tribes develop their thesaurus and organization of local Tribal collections, it is possible to truly rethink how it should be done for each Culture.

Recommendations

- Create a classification system that allows hierarchical searching similar to PubMed/Medline thesaurus where an EXPLODE command becomes very useful or the NAICS system that allow searching by less than the full code to get the code and subcodes. This also solves excessive use of keywords.
- Include more general terms in the indexing to broader groupings as well as the specific or detailed words.
- Index to the most specific public term, knowing that any trade secret, that is to say, Tribal Traditional Knowledge, has subject terms included but accessible only to those who are authorized.
- Create public Indigenous terms that include the spiritual/philosophical aspects of the same general colonial term.
- Since many full documents may not be appropriate for all to see, make sure that the Indigenous terms for the public are included in the abstracts and indexing used. This is especially true for indexing open access scholarly research by Indigenous authors where the data set or parts of the research may be protected.
- Searching full text requires advanced proximity searching beyond phrases in " ", such as "Ancient Puebloan" for more accurate results. This most often is done by using the PROXIMITY commands as WITH, NEAR, or PRE that specify that the words to the left and right must be within so many words of each other. Software allowing such proximity flexibility is to be a desired feature of the programming.

Designing nomenclature and classifications systems for Tribal Archives and Collections to accommodate both Indigenous Culture and the related dominant culture material is as challenging as using the dominant culture's existing databases. The lessons learned through this searching exercise points to possibilities for rethinking the uses of technology in the organization of information within the Tribe's world view.

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