Spanish Abstract

A pesar de ser una de las regiones más densamente pobladas del mundo, el arte rupestre del sudeste asiático es relativamente desconocido y el arte rupestre de Micronesia lo es aún menos. Como punto de partida para poder comparar el arte rupestre Filipino con la región, se llevó a cabo una revisión sistemática cuantitativa de literatura (SQLR por sus iniciales en inglés) del arte rupestre del sudeste asiático y Micronesia para evaluar el cuerpo actual de publicaciones accesibles. El SQLR resultó en 126 referencias viables y las características de esas referencias fueron cuantificadas y analizadas para determinar las cualidades de la investigación publicada hasta la fecha. Los resultados de SQLR muestran que la investigación en el arte rupestre del sudeste asiático está aumentando y que las publicaciones están dominadas por investigadores afiliados a Australia. También afirmó cuantitativamente que el rojo y el antropomorfo son el color y el motivo más prevalentes en la región. Muchos motivos encontrados en otras partes del sudeste asiático están notablemente ausentes en el corpus conocido del arte rupestre Filipino. Finalmente, se examina el método de SQLR y se propone la integración de aplicaciones web semánticas colaborativas para aumentar la eficiencia y la relevancia.
The aim of this paper is to demonstrate the potential of conducting a systematic quantitative literature review (SQLR) for answering archaeological questions. A traditional narrative literature review relies on the credibility of the author’s reputation as a recognized expert in the field, as opposed to the SQLR where the reliability is on the method itself and the results are consistent, quantifiable, and repeatable. Systematic reviews have been gaining popularity in the natural and social sciences (see Griffith University School of Environment and Science (2018) for a list of over 100 publications in different disciplines utilizing the SQLR method). In this paper we demonstrate how to adapt this well-established method for archaeological studies, producing what may be the first systematic quantitative literature review of rock art for any region.

A traditional narrative review is still very much a valid approach because it is comprehensive, covers a wide range of issues, and is usually more readable than an SQLR by being narrative focused (Collins and Fauser 2005). However, the highly subjective nature of traditional narrative reviews expose them to potential bias (Petticrew and Roberts 2006; Pickering and Byrne 2013). In contrast, the strength of a SQLR is that it is useful for addressing specific questions because of the keyword data search, the transparency of the method exposes bias, and the quantitative summary allows for evidence-based inferences (Collins and Fauser 2005; Cook et al. 1997). Traditional narrative reviews may be more appropriate for comprehensive topics, while systematic reviews are more effective for focused topics (Collins and Fauser 2005). Therefore, the systematic quantitative approach is suitable for initiating a literature review of Philippine rock art, which is an obscure topic in a sub-discipline of archaeology.

The work presented in this paper is adapted from a chapter of the doctoral thesis of one of the authors (AJ) on the rock art of the Philippines. The SQLR was used to compare the rock art of the Philippines with the neighbouring areas and to expose gaps in the research. It was not intended to be a comprehensive account of all the rock art research in Southeast Asia (SEA). The specifics of rock art sites and motifs of the region will not be elaborated upon in this paper. However, the rock art of the region is used to demonstrate how quantifying the information, such as in the SQLR, can be used to understand the rock art of the Philippines. There is also a discussion on prominent elements of the rock art of the region that are not found in Philippines and why rock art is absent in parts of SEA and Micronesia.

The next section provides the context of rock art research in Southeast Asia and Micronesia. Afterwards, the method, limitations and results of the SQLR are discussed. Finally, the potential for increasing the usability of the SQLR in collaborative semantic web applications is considered. While an SQLR is a powerful tool to analyse the literature, its fundamental weakness is that it is static. In contrast, a collaborative semantic web application is dynamic.
Background

The rock art of SEA is not well known and there is a disparate amount of research done across SEA (Tan 2014a; Tan and Taçon, 2014). Even less rock art research has been generated in Micronesia. Moreover, the research is often not published in international peer review journals but remains as restricted access museum papers, or is published in local languages. All these issues make the rock art of the region, Southeast Asia and Micronesia, difficult to generalize.

Summaries of Southeast Asian rock art have been produced by Tan and Taçon (2014); Scott and Tan (2016); Taçon (2017); Tan (2014b) and Taçon et al. (2014). Taçon (2017) cited all the seminal work in the region. Tan (2014a) synthesized the known rock art of Mainland Southeast Asia and Island Southeast Asia. Taçon et al. (2014) focused on the painted sites of the region, including China, in understanding a shared rock-marking legacy with the rest of the world. Scott and Tan (2016) provided a general update on the rock art research for Southeast Asia. In-depth discussion on the rock art of specific locations are best found in PhD theses that go into detail of MSEA (see Taha 2000; Tan 2014a), Borneo (see Hoerman 2016), and the Philippines (see Jalandoni 2018), as well as books on West Papua and Indonesia (see Arifin and Delanghe 2004; Permana 2015). The seminal summary of Micronesian rock art is found in doctoral thesis of Jalandoni (2018).

Cruz Berrocal and Millerstrom (2013) noted that similarities in rock art motifs do not automatically demonstrate interaction on a large scale. Commonalities in rock art first need to be identified before they can be considered associated.

Rock art has been an unexploited archaeological resource for understanding Austronesian migration until the recent efforts of Hoerman (2016); Tan (2016a); O’Connor (2015); O’Connor et al (2018) and Jalandoni (2018). Tan (2016a) outlined the geographic boundaries of the rock art theories about Austronesian migration while Hoerman (2016) and O’Connor (2015) tested the validity of the two rock art theories that relate to Austronesians in discrete Southeast Asian contexts. The first rock art theory put forward concerns the spread of what has been called the Austronesian Engraving Style as proposed by Specht (1979) in the western Pacific. The second theory focuses on the movement of an Austronesian Painting Tradition identified by Ballard (1988, 1992) in Indonesia and East Timor. The results provided by the SQLR are limited, however the SQLR can answer the question of where these rock art theories have been mentioned in the rock art literature. Therefore, the SQLR is able to provide a delineation of where these rock art theories have been applied.

Systematic Quantitative Literature Review (SQLR)
The ‘Rock Art Studies: A Bibliographic Database’ compiled by Marymor (2018) is an invaluable resource for rock art researchers, and is perhaps an example of a systematic literature review if the methodology of compilation was more explicit. The study reported in this paper is different because the search parameters are clearly provided. If another researcher were to duplicate the parameters, the results should be virtually identical. By providing the search parameters, creating categories, and tabulating data, this study provides a literature review that is both systematic and quantitative.

The methodology employed for the systematic literature review followed from Petticrew and Roberts (2006) and the quantitative aspect from Pickering and Byrne (2013). For a detailed step-by-step instruction on conducting a SQLR, refer to Pickering and Byrne (2013).

**Parameters**


Hong Kong and Taiwan were included, even if they are not officially part of Southeast Asia, because of their proximity to the Philippines. The rock art terminology included ‘rock art’, ‘rock-art’, ‘cave art’, ‘painted site’, ‘pictograph’, ‘pictogram’, ‘stencil’, ‘engravings’, and ‘petroglyph’. While there may be other fringe terms used for rock art, these are the most common for the region and should be sufficient for catching all relevant publications.

Other databases, such as JSTOR, Science Direct, Scopus, Web of Knowledge, were tested but did not provide additional references. Other sources of data were from personal libraries and reference sections of publications. While atypical for systematic reviews of this kind, Masters and PhD theses, books, abstracts, and conference proceedings that were available through the online databases were included, in addition to the standard peer-reviewed articles. Also, only papers published in English were included in this study. While these limitations might limit the scope, they were necessary because a comprehensive list of all the literature available on the rock art of SEA and Micronesia region would have required physically visiting museums and historic preservation offices across the region. It may also necessitate months of waiting for access permits and lifted restrictions on copies. Even if copies were obtained, they would entail translating the text from, for example, Bahasa Indonesia, Bahasa Malay, Thai, Vietnamese, Khmer, and Mandarin. For this reason, we did not include the
museum papers because they would bias the counts in favour of areas we have worked in extensively (e.g. Philippines, Palau, Guam, and Saipan).

The data were collected between 19 May and 15 June 2017. Publications uploaded or released after that date were not included. Since algorithms of the search engines change periodically and without warning, it was best to do the searches within a short time frame. The database, contained in a spreadsheet, is housed in Griffith University’s digital network data storage facility.

Workflow

A flowchart of the method is presented in Figure 1. Every record identified in the database search was added to a spreadsheet. Duplicated records were removed and each record was screened for access and language. The remaining abstracts, presentations, books, book chapters, theses, and journal articles were read. Entries that were out of scope regionally or where rock art was not mentioned were excluded at this stage. The entries that remained eligible were tabulated on an Excel spreadsheet based on where the authors were affiliated, year of publication, journal title (if applicable), geographic region, kind of rock art, artist, sites discussed, and methods used in study. Some categories, for example geographic region, remained fixed from the conceptualization of the study. Other categories were revised when the need was recognized during tabulation (as is suggested by Pickering and Byrne 2013). For example, “Material Culture” was added as a category under “Symbols” when several were written in as notes in the spreadsheet.

Limitations

The SQLR quantifies references to rock art in geographic regions. The counts can be biased in places where several references exist for one site (e.g. Tan 2009; Tan and Chia 2010, 2011; Tan and Chia 2012 for Gua Tambun in Malaysia), which may give the impression that there is more rock art in the area. Conversely, there are also references that discuss several rock art sites in a single geographical area yet are only counted once (e.g. Fage and Chazine 2010 for Kalimantan; Faylona et al. 2016 for Peñablanca in the Philippines). Therefore, the summations produced by the SQLR should not be interpreted as quantity of sites, but as quantity of research with no indication of quality.

Results and Metrics

The search through all the databases returned 404 entries and an additional ten were unsearched personal sources. After duplicates were removed and the entries screened for language and access, 277 references remained. Those 277 references were further analysed but 151 were then further excluded for not being related to rock art, periphery mention or not within scope. A total of 126
references were included in the systematic review. The density of research per geographic region is presented in Figure 2.

The SQLR also confirmed that the amount of research produced in the region is generally on an upward trend (Figure 3). The search was conducted mid-year and therefore the results for 2017 are only until May-June, but already show a trend of similar high frequency as previous years. Author affiliation included all authors but does not double count for a single publication (Figure 3). For example, one article may have 5 Australian authors and 1 Indonesian but will only be counted 1 Australia and 1 Indonesia. The category of “Other” is spread over Hong Kong, Taiwan, Netherlands, New Zealand, China, Russia and Micronesia with no dominant country. This metric is an indication of where the funding is originating and perhaps where the expertise can be found. Australia dominates the rock art research of the region, specifically in Southeast Asia. Furthermore, there is a significant subset of Southeast Asians who have written their doctoral theses and published their work while affiliated with Australian universities. Finally, a count of the methods identified demonstrated that rock art research in Southeast Asia and Micronesia is still in its incipient stages. The method in the majority of the publications is the basic level of literature review, observation, and recording (Figure 3). There has not been much research on dating, pigment analysis, or interpretation.

**Philippine Rock Art as the Focal Point**

The systematic quantitative literature review of Southeast Asian and Micronesian rock art was conducted to understand the context of Philippine rock art in the region. Therefore, the following sections demonstrate how the data can be used to describe the rock art of the region and relation to the Philippine rock art.

Tan and Taçon (2014: 68) observed that paintings are the most dominant form of rock art in SEA and they are predominantly done in red. Using the data from the SQLR, it is easy to visualize that a lot more research has been done on painted sites than engraved sites, perhaps indirectly indicating that there are indeed more painted sites (Figure 4). Of the painted sites, red (n=74) is mentioned almost as many times as all other colours combined. It would appear that red is indeed the dominant pigment, especially combined with colours on a similar palette (e.g. orange, brown, and purple) where differences may be due to semantics. Black (n=45) is next common after red, while white (n=17) paintings seem more dominant proportionally in the Marianas than in SEA. Black, which is presumed to be charcoal, and polychromatic paintings are presumed to be more recent than red (Tan and Taçon 2014: 68). Interestingly, Specht (1979) noted similar dominance of red followed by black in the southwestern Pacific.
The most commonly mentioned painted motifs are zoomorphs (n=64) and anthropomorphs (n=63) while plenty of hand stencils (n=47) and geometrics (n=39) are also mentioned (Figure 4). Painted boats (n=24) and other material culture (n=25), usually weapons, are noted at several different research areas. Interestingly, the most common engraved motifs in the literature are anthropomorphs (n=34) then zoomorphs (n=29), indicating some importance that transcends the type (i.e. painting or engraving) of rock art. Geometrics (n=21) are the third most mentioned engraved motif.

Tools for producing the art are rarely mentioned in the body of literature analysed (Figure 4). Three out of the five times metal is mentioned, by Peralta (1973, 2000) and Novellino (1999), describing the engravings in Angono and Palawan, Philippines. Inadvertently, Fage and Chazine (2010: 42) indicated metal was used when they noted that some of the engraved lines could be a result of weapon sharpening. The sole painted site where tools were mentioned is one with pigment splash-marks in Myanmar that can only be made with tools and are reminiscent of a style of rock art production in Australia (Aung 2013; Taçon et al. 2004).

There are numerous references to painted boats in sites throughout SEA (e.g. Aubert et al. 2014; Ballard 1988; Ballard et al. 2004; Lape et al. 2007; O’Connor 2003; Pyatt et al. 2005; Szabó et al. 2008). Sites with engraved boats in SEA are less common but there are examples of engraved boats in Borneo (see Hoerman 2016; Saidin et al. 2008; Szabó et al. 2008; Taçon et al. 2010), Maluku (see Spriggs et al. 1998; Spriggs et al. 2005), West Papua (see Arifin and Delanghe 2004), Thailand (see Sukkham et al. 2017), and Philippines (see Dizon et al. 2008). In Micronesia, there are engraved boats reported only in Pohnpei (see Rainbird 2008).

What does Southeast Asian rock art have that Philippines rock art does not?

Instead of listing every non-existent motif, colour, and style of Philippine rock art with the rest of Southeast Asia, only the prominent absences are mentioned. Hand stencils are conspicuously absent from Philippine rock art, though they are quite prominent in the region (e.g. found in Borneo [Chazine and Noury 2006; Fage 2005; Fage and Chazine 2010]), Sulawesi (Oktaviana et al. 2016), East Timor (O’Connor 2003), and Maluku (Latinis and Stark 2005)). The Philippines has a few zoomorphs in the rock art but they are all of small animals (e.g. interpreted as insects or birds), while there are large zoomorphs in many sites in SEA, e.g. Malaysia (Tan 2009), Cambodia (Heng 2011; Taçon et al 2014), Thailand (Tan 2016b), Sulawesi (Aubert et al. 2014), Borneo (Plagnes et al. 2003), and West Papua (Arifin and Delanghe 2004). Engraved faces, which are part of the description of Austronesian Engraving Style provided by Specht (1979), are also not found in the Philippines, but are present in Borneo (Fage and Chazine 2010; Hoerman 2016), East Timor (O’Connor et al. 2010), West Papua (Arifin and Delanghe 2004) Vietnam (Nguyen 2014) and Taiwan (Ching 2009; Kao 1991). While there are two
red painted rock art sites in the Philippines, the majority of the currently known sites have black figures, unlike the proportion in the whole SEA of red dominant sites.

**What can be said about Austronesian Painting Tradition and Austronesian Engraving Style using the SQLR?**

There are scarce mentions of possible ethnicity of artists in the available literature. Aside from the Negritos and IP discussed above, there are mentions of four modern artist groups, four “Austronesians” with no reference to rock art theories, 13 mentions of Austronesian Painting Tradition, and five Austronesian Engraving Style. All the references to Austronesian Painting Tradition are from research conducted surrounding the Banda Sea including Borneo (e.g. Aubert et al. 2007; Ballard 1988; Chazine and Setiawan 2005; O’Connor 2015; Oktaviana et al. 2016; Wilson 2004). Tan and Chia (2010) mention Austronesian Painting Tradition in passing while discussing a site in Malaysia, but not as a classification for the site. Therefore, the SQLR corroborates the conclusion of Bulbeck (2008), O’Connor (2015), and O’Connor et al. (2015) that the Austronesian Painting Tradition is limited to the Banda Sea area. Since none of the currently known sites in the Philippines conform to the parameters of Austronesian Painting Tradition, it seems that the style does not extend north or has not been recognized in other areas.

While the Austronesian Engraving Style has been proposed to be prolific in the Pacific (O’Connor 2015; Specht 1979; Wilson 2002), Micronesia is an exception. Aside from the single site in Tinian and confirmed single site in Pohnpei, there are no other exclusively engraved rock art sites in Micronesia. The other known sites with engravings in the Marianas have just a few figures. However, Wilson (2004) does include Pohnpei in her analysis and concluded through statistical analysis that a large number of motifs are likely the result of local innovation but there is also significant overlap across the region.

The rock art of Wanshai, Taiwan (Ching 2009), corresponds with all three criteria of Austronesian Engraving Style provided by Specht (1979). The engraved motifs are curvilinear geometric, concentric, spirals, and faces. The rock art is on open faced boulders and similar exposed bedrock, and not in caves. Furthermore, the art is located near aboriginal Taiwanese who are Austronesian-speakers, perhaps the most genetically and linguistically pure Austronesians, though the Taiwanese researchers deny that the aboriginals are the artists. However, it needs to be considered whether the description of Austronesian Engraving Style as “curvilinear geometrics” and “face-like forms” is too broad and encompassing, though they are also defined by location on exposed rocks and in Austronesian-speaking areas. Still, curvilinear geometric forms like spirals and concentric circles are found all over the world, e.g. England (Mazel 2017), USA (Loendorf 2001), Spain (Bradley et al. 1994), as are face-like forms (for many parts of the world see Watson 2015; for Russia see Ponomareva 2018; for North
America see Lenik 2002; for China see Dematte 2011; for Australia see Brady and Carson 2012, McDonald 2005 and Mulvaney 2010). Perhaps the rock art of Taiwan fits the criteria of Austronesian Engraving Style because the criteria of the style is too general. A more specific description of the style of faces may provide a more narrow definition of Austronesian Engraving Style. There are only a handful of sites in Southeast Asia with engraved faces and they are widely distributed.

The currently known sites in the Philippines do not conform to Austronesian Engraving Style. Perhaps future sites will be found in the Philippines that can be classified as Austronesian Painting Tradition or Austronesian Engraving Style, but at present those theories do not apply to Philippine rock art. Furthermore, the dominance of vulva-forms in the known engraved sites in the Philippines and relative absence in the rest of SEA and Micronesia suggest a local evolution for the universal motif (Jalandoni 2018). Alternatively, there is also evidence of temporal and regional rock art traditions across Southeast Asia, as proposed by Taçon et al. (2014), and that is supported by the similarities in some rock art styles between the Philippines and Southeast Asia

Micronesia as a resource for determining an Austronesian art style should not be underestimated. Unlike SEA, the migration into Micronesia is well understood and there were no other populations on arrival. Austronesians were the first to arrive in Micronesia, as early as 3500 BP in the Marianas, which is just 500 years after their arrival in the Philippines (Hung et al. 2011). It is extremely likely that Austronesians are the artists of the rock art in Micronesia, but how long ago is still unknown.

Localities with little to no rock art

According the SQLR, Brunei is only mentioned once (see Tan 2014b) and that is in reference to having no rock art. Singapore is mentioned in two publications and in a PhD thesis that are overviews of the region (Taçon 2017; Tan 2014a; Tan 2014b) because the only known rock art site was demolished, but a section remains in the National Museum of Singapore. These are the only two countries in Southeast Asia without rock art, which is an indication of the futility of grouping rock art by political boundaries. Both Singapore, on the tip of the Malay Peninsula, and Brunei, on Borneo, are tiny countries on landmasses with copious amounts of rock art. Therefore, researchers like Chazine and Setiawan (2005) and Hoerman (2016) correctly approach the rock art beyond political boundaries by considering Indonesian Kalimantan and Malaysian Borneo as one island rock art ‘province’ in their analyses.

The rock art across Micronesia is sporadic. There is rock art on every currently inhabited island of the Marianas (Guam, Rota, Saipan, and Tinian), while the uninhabited islands may not have been surveyed for rock art. In Micronesia, no rock art has been reported for Marshall Islands, Chuuk, Yap, and Kosrae. While in the FSM, only the rock art of Pohnpei has been recorded, and there may be an additional site
in Pohnpei and another site on Kosrae (Historic Preservation Office archaeologist, J. Lebehn, pers. comm. 26 February 2017). The geology of the atolls in Micronesia is unconducive to rock art creation or preservation. However, an in-depth study is needed to understand why some inhabited islands in Micronesia have rock art while others do not, before it can be completely attributed to geology.

**Conclusion**

While the analysis of the data for this paper has focused on the Philippines, the database could just as easily be used with a different country as the focal point or a different material culture. It can also be used to answer questions such as, “where are the known engraving sites in Southeast Asia?”, “Which countries have been funding and conducting research in Indonesia?”, or “Where are there known painted hands?”; with “known” being equivalent to “published and available online in English.” The questions and answers are limited by the parameters of the search and the variables noted during the processing phase.

The strength of the SQLR is in identifying research gaps and trends, but answering or explaining the results is beyond the scope of the SQLR and may require further investigation. For example, while the SQLR in this study identified and quantified the dominance of Australia in Southeast Asian rock art research it did not explain it. The SQLR, like all literature reviews, is excellent at answering questions of “who”, “what”, “where”, and “when”, but is limited on answering “why”.

In summary, the reliability of the SQLR comes from the systematic way data were collected and the usefulness of the SQLR is from quantifying the data. The SQLR is a powerful method for conducting literature reviews that is suitable for quantitatively focused archaeologists.

**Improving SQLR through Collaborative Semantic Web Applications**

The SQLR has proven useful for assessing information about rock art sites in the region by quantifying data from a list of publications. Managing the information in Excel was an effective way to analyse the data but the process could be optimized by improving a) data collection, b) management, and c) extraction method. Therefore, a collaborative semantic web application (CSWA) is a more organic approach of combining and working the data collection and data management tasks into the usual day to day work routine. The differences between the standard SQLR, such as the one conducted for this paper, and an SQLR that uses CSWA are summarized in Table 1.

While collecting the data for the SQLR took just under one month, a more collaborative approach through a central repository for rock art data would speed up the search for rock art publications. Also, it would allow for the database to be organically updated, compared to the standard SQLR that
is compiled from a static predefined period of time by a single person or a handful of people. In the example presented here, any rock art publications for the region released after 15 June 2017 are not included. In order to update the database, a search with new parameters for dates would have to be conducted and the data retabulated.

The Global Rock Art Database (Haubt and Taçon 2016) is a first attempt towards centralizing rock art data. Currently it does not feature enough publications and also does not allow to search publication content or extract data from publications. However, it is a proof-of-concept of the potential for a centralized rock art database powered by collaborative data collection.

A new project, [www.wikidemia.info](http://www.wikidemia.info), has been developed by one of the authors (RH). [Wikidemia.info](http://www.wikidemia.info) is a collaborative research platform that allows researchers to upload their research profiles (similar to LinkedIn) and their publications (similar to ResearchGate and [Academia.edu](http://www.academia.edu)). The platform allows researchers to semantically annotate and tag in-text information in publications on [Wikidemia.info](http://www.wikidemia.info) without the need for separate external files such as Excel Spreadsheets. The tagged and annotated information can then be compared to other data in publications in the database and allows researchers to visually explore and analyse relationships in complex research datasets. Similar to Wikipedia, all data within [Wikidemia.info](http://www.wikidemia.info) is shared with the community and contributes to the development of a global research knowledge base by sharing research profiles, publications and structured data through the semantic tagging and annotation approach that can in turn then again be used by other researchers for further studies. Future research will consider testing [www.wikidemia.info](http://www.wikidemia.info) to improve the data collection, management and extraction process for the SQLR method so that it can be applied in other world rock art regions as well as more generally for archaeological and heritage research.

**List of Figures and Captions**

Figure 1 Flow chart using PRISMA (preferred reporting items for systematic reviews and meta-analyses) statement for the systematic review (adapted from Moher et al. 2009).

Figure 2 Density of research by geographic region. Source Maria Kottermair and Andrea Jalandoni.

Figure 3 Distribution by year until mid-2017 and every dot represents a publication (top). Author affiliation by country as listed on publication (middle). Methods identified in publications (bottom).

Figure 4 Progressive circle packing of the SQLR. Interactive version available at [http://www.rockartdatabase.com/v2/author/andrea-jalandoni](http://www.rockartdatabase.com/v2/author/andrea-jalandoni) (Top). Tabulations of references made to elements of paintings and engravings (Bottom). Source Maria Kottermair and Andrea Jalandoni.

Figure 5 Examples of Philippine rock art: engraved anthropomorphs from Angono (Top) and black painted botanics from Penablanca (Bottom). Photographs by Andrea Jalandoni.
Table 1 Differences between standard SQLR and using Collaborative Semantic Web Applications
References Cited

Arifin, Karina, and Philippe Delanghe


Aubert, M., A. Brumm, M. Ramli, T. Sutikna, E. W. Saptomo, B. Hakim, M. J. Morwood, G. D. van den Bergh, L. Kinsley, and A. Dosseto


Aubert, Maxime, Sue O’Connor, Malcolm McCulloch, Graham Mortimer, Alan Watchman, and Marc Richer-LaFlèche


Aung, Yee Yee


Ballard, Chris

Ballard, Chris

1992  Painted rock art sites in western Melanesia: locational evidence for an
'Austronesian' tradition. *State of the Art Regional Rock Art Studies in Australia and
Melanesia* Occasional AURA Publication 6:94-106.

Ballard, Chris, Richard Bradley, Lise Nordenborg Myhre, and Meredith Wilson

2004  The Ship as Symbol in the Prehistory of Scandinavia and Southeast Asia. *World
Archaeology* 35 (3):385-403. DOI: 10.1080/0043824042000185784.

Bradley, Richard, Felipe Criado Boado, and Ramon Fabregas Valcarce

1994  Rock art research as landscape archaeology: A pilot study in Galicia, north-west

Brady, Liam M, and Anneliese Carson

2012  An archaic face from the Woodstock Abydos protected reserve, northwestern
Western Australia. *Australian Archaeology* 74 (1):98-102.

Bulbeck, David

2008  An Integrated Perspective on the Austronesian Diaspora: The Switch from Cereal
Agriculture to Maritime Foraging in the Colonisation of Island Southeast Asia. *Australian

Chazine, J-M, and A Noury

Chazine, Jean-Michel, and Pindi Setiawan


Ching, Min-Liang


Collins, John A., and Bart C. J. M. Fauser

Balancing the strengths of systematic and narrative reviews. *Human reproduction update* 11(2):103-104.

Cook, D. J., C. D. Mulrow, and R. Haynes


Cruz Berrocal, María, and Sidsel Millerstrom

Dematte, Paola


Dizon, Eusebio Z., Jose G. Santiago, and Bobby C. Ornillaneda


Fage, Luc-Henri

2005 Hands across time: exploring the rock art of Borneo. *National Geographic*,


Fage, Luc-Henri, and Jean-Michel Chazine

2010 *Borneo: Memory of the Caves*. Le Kalimanthrope, Jakarta.

Faylona, Marie Grace Pamela G., Caroline Marie Q. Lising, and Eusebio Z. Dizon

Griffith University School of Environment and Science


Haubt, Robert A, and Paul SC Taçon


Heng, Than


Hoerman, Rachel B.

2016 Utilizing rock art to trace human migration: Case studies from Sarawak, Malaysian Borneo. PhD dissertation, Department of Anthropology, University of Hawai'i, Honolulu.

Hung, Hsiao Chun, Mike T Carson, Peter Bellwood, Fredeliza Z Campos, Philip J Piper, Eusebio Dizon, Mary Jane Louise A Bolunia, Marc Oxenham, and Zhang Chi

Jalandoni, Andrea

2018 The archaeological investigation of rock art in the Philippines. PhD dissertation, School of Humanities, Griffith University, Gold Coast, Australia.

Kao, Ye Rong


Lape, Peter V., Sue O’Connor, and Nick Burningham


Latinis, D Kyle, and Ken Stark


Lenik, Edward J


Loendorf, Larry

Marymor, Leigh (Compiler)

2018  Rock Art Studies: A Bibliographic Database.


Mazel, Aron


McDonald, Jo


Moher, David, Alessandro Liberati, Jennifer Tetzlaff, Douglas G Altman, and Prisma Group


Morwood, Michael J

2002  *Visions from the past: the archaeology of Australian Aboriginal art*. Smithsonian Institution Press, Washington DC.
Mulvaney, Ken


Nguyen, Viet


Novellino, Dario


O'Connor, Sue


2015 Rethinking the Neolithic in Island Southeast Asia, with Particular Reference to the Archaeology of Timor-Leste and Sulawesi. Archipel 90:15-47.

O'Connor, Sue, Ken Aplin, Emma St Pierre, and Yue Xing Feng

O'Connor, Sue, Julien Louys, Shimona Kealy, and Mahirta


O'Connor, Sue, Louys, Julian., Kealy, Shimona. and Brockwell, Sally


Oktaviana, Adhi Agus, David Bulbeck, Sue O'Connor, Budianto Hakim, Unggul Prasetyo Wibowo, Emma St Pierre, and Fakhri


Peralta, Jesus T.


Peralta, Jesus T.

Permana, R. Cecep Eka (ed.)


Petticrew, Mark, and Helen Roberts


Pickering, Catherine, and Jason Byrne


Plagnes, Valérie, Christiane Causse, Michel Fontugne, Hélène Valladas, Jean-Michel Chazine, and Luc-Henri Fage


Ponomareva, Irina

Pyatt, F. B., B. Wilson, and G. W. Barker


Rainbird, Paul


Saidin, Mokhtar, Paul Taçon, Yang Decong, George Nash, Sally May, and Barry Lewis


Scott, V. N., and N. H. Tan


Specht, Jim R.

Spriggs, Matthew, Peter Veth, and Susan O’Connor


Spriggs, Matthew, Peter Veth, Sue O’Connor, Husni Mohammad, Ako Jatmiko, Widya Nayati, Aliza Diniasti Saleh, and Djoko Witjaksono


Sukkham, Atthasit, Paul SC Taçon, Noel Hidalgo Tan, and Asyaari Bin Muhamad


Szabó, Katherine, Philip J Piper, and Graeme Barker

Taçon, Paul SC


Taçon, Paul S. C., Daw Yee Yee Aung, and Alan Thorne


Taçon, PSC, MS Sauffi, and I Datan


Taçon, Paul, Noel Hidalgo Tan, Sue O'Connor, Ji Xueping, Li Gang, Darren Curnoe, David Bulbeck, B. Hakim, Iwan Sumantri, Heng Than, Im Sokrithy, Stephen Chia, Khoun Khun-Neay, and Soeung Kong


Taha, Adi Haji

2000 Archaeological investigations in Ulu Kelantan, Peninsular Malaysia. PhD dissertation, School of Archaeology and Anthropology, Australian National University, Canberra, Australia.
Tan, Noel H.


Tan, Noel H.

2014a Painted Sites, Sacred Sites: An examination of religious syncretism in Southeast Asia through rock art site usage. PhD dissertation, School of Archaeology and Anthropology, Australian National University, Canberra, Australia.

Tan, Noel H.


Tan, Noel H.


Tan, Noel H.


Tan, Noel H., and Stephen Chia

Tan, Noel H., and Stephen Chia


Tan, Noel H., and Stephen Chia

2012 Revisiting the Rock Art at Gua Tambun, Perak, Malaysia. Crossing borders: selected papers from the 13th International Conference of the European Association of Southeast Asian Archaeologists, Singapore.

Tan, Noel H., and Paul Taçon


Watson, Ben

2015 The eyes have it: human perception and anthropomorphic faces in world rock art. *Antiquity* 85 (327):87-98. DOI: 10.1017/S0003598X00067454.

Wilson, Meredith

PhD dissertation, School of Archaeology and Anthropology, Australian National University,
Canberra, Australia.

Wilson, Meredith

2004  Rethinking regional analyses of western Pacific rock-art. In A Pacific Odyssey:
Archaeology and Anthropology in the Western Pacific. Papers in Honour of Jim Specht.
<table>
<thead>
<tr>
<th>Standard SQLR</th>
<th>Collaborative Semantic Web Applications SQLR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work done by 1 person or a group</td>
<td>Work is crowdsourced</td>
</tr>
<tr>
<td>Variables are predefined</td>
<td>Semantic approach uses an ontology to allow interpretation of variables</td>
</tr>
<tr>
<td>Data is static; Information can be added, but in order to change an element (e.g. a variable), the model has to be reconsidered</td>
<td>Ontological metadata approach towards the semantic web gives more flexibility and explores information not through cluster and categories but through relationships - this allows to identify clusters rather than making assumptions on what a cluster is</td>
</tr>
</tbody>
</table>
**Supplementary Materials.** For supplementary material accompanying this paper, visit [www.journals.cambridge.org/AAP](http://www.journals.cambridge.org/AAP).

**R code for Figure 3**

```r
# setView( lng = 166.45, lat = 21, zoom = 2)
# Circles on map
# Maria Kottermair and Andrea Jalandoni
# Feb 11 2018

Setwd #location of files
data <- read.csv #file
head(dat)
str(dat)

#library
library(leaflet)
library(tidyverse)
library(mapproj)
library(leaflet)

# Get the world polygon and extract UK
library(maps)

# Create 20 markers (Random points)
data=data.frame(long=sample(seq(-150,150),20) , lat=sample(seq(-50,50),20) ,
val=round(rnorm(20),2) , name=paste("point",letters[1:20],sep="_") )
long <- data$Long
lat <- data$Lat
val <- data$Count
name <- data$Country
main <- dat[grep("Mainland", data$Geographical.Region),]
isl <- dat[grep("Island", data$Geographical.Region),]
oth <- dat[grep("Others", data$Geographical.Region),]
nw <- dat[grep("Northwest", data$Geographical.Region),]

Pal <- c("red", "cornflowerblue", "lightgreen", "yellow", "black")

# Show a CUSTOM circle at each position. Size in meters --> change when you zoom.
m=leaflet(data = data) %>% addTiles() %>% addProviderTiles("Esri.WorldImagery") %>%
  addCircles(~long, ~lat,
             radius=~val*13000,
             color = Pal[as.numeric(data$Geographical.Region)],
             stroke = TRUE,
             fillOpacity = 0.4,
             popup = ~as.character(name)
  )
m
```

Supplemental
R code for Figure 4

# Interactive circle packing with circlepackeR
# Maria Kottermair and Andrea Jalandoni
# Feb 11 2018

library(devtools)

devtools::install_github("jeromefroe/circlepackeR")

library(circlepackeR)
library(ggraph)

?rep

data <- read.csv #file
head(data)
group <- data$group
subgroup <- data$subgroup
subsubgroup <- data$subsubgroup
value <- data$value

# create a nested data frame giving the info of a nested dataset:
#data=data.frame(  
#  root=rep("root", 15),
#  group=c(rep("group A",5), rep("group B",5), rep("group C",5)),
#  subgroup= rep(letters[1:5], each=3),
#  subsubgroup=rep(letters[1:3], 5),
#  value=sample(seq(1:15), 15)
#)

# Change the format. This use the data.tree library. This library needs a column that looks
# like root/group/subgroup/..., so I build it
library(data.tree)
data$pathString <- paste("world", data$group, data$subgroup, data$subsubgroup, sep = "/")
population <- as.Node(data)

# Make the plot
circlepackeR(population, size = "value")

# You can custom the minimum and maximum value of the color range.
#circlepackeR(population, size = "value", color_min = "hsl(56,80%,80%)", color_max = 
#"hsl(341,30%,40%)")
?circlepackeR
A SYSTEMATIC QUANTITATIVE LITERATURE REVIEW OF SOUTHEAST ASIAN AND MICRONESIAN ROCK ART

Andrea Jalandoni, Paul Taçon, and Robert Haubt

DO NOT CITE IN ANY CONTEXT WITHOUT PERMISSION OF THE AUTHOR(S)

Andrea Jalandoni and Paul Taçon Place, Evolution and Rock Art Heritage Unit, Griffith Centre for Social and Cultural Research, Australian Research Centre of Human Evolution, Gold Coast campus, Griffith University, Queensland 4222, Australia (a.jalandoni@griffith.edu.au, corresponding author)

Robert Haubt School of Arts & Social Sciences, Lismore campus, Southern Cross University, Military Road, East Lismore New South Wales 2480, Australia