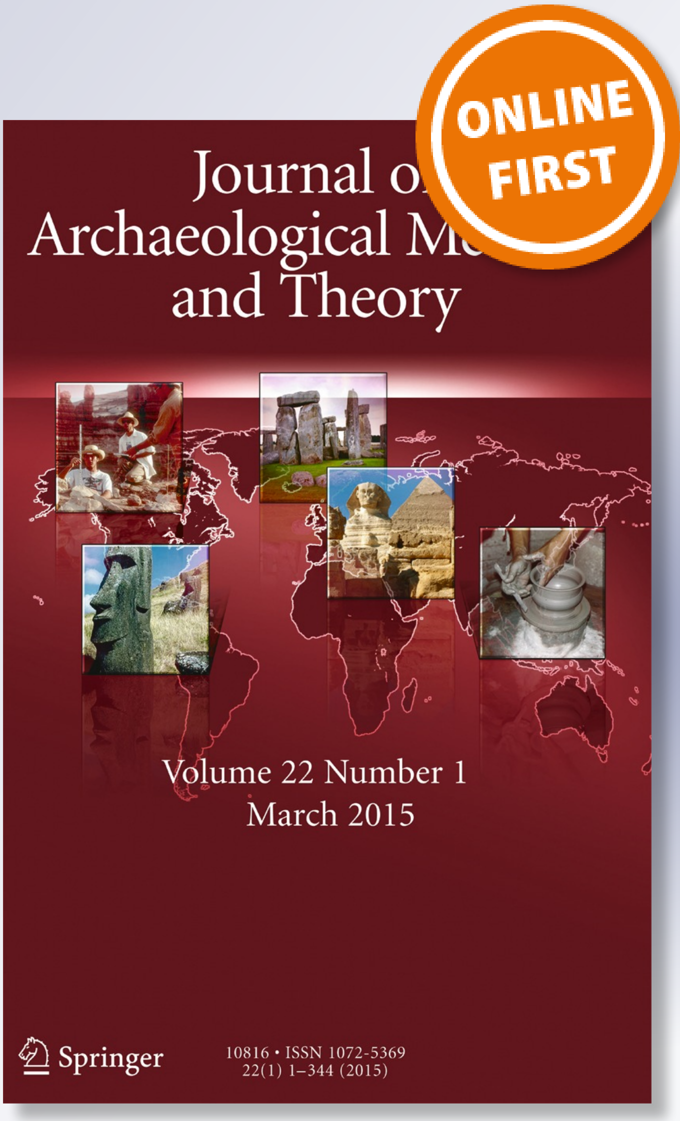
The "Hidden" Code: Coding and Classifying in Rock Art. The Case of Northwestern Patagonia

Vivian Scheinsohn, Claudia Szumik, Sabrina Leonardt & Florencia Rizzo

Journal of Archaeological Method and Theory

ISSN 1072-5369

J Archaeol Method Theory
DOI 10.1007/s10816-015-9249-8



J Archaeol Method Theory
DOI 10.1007/s10816-015-9249-8

The "Hidden" Code: Coding and Classifying in Rock Art. The Case of Northwestern Patagonia

Vivian Scheinsohn [1,2] · **Claudia Szumik** [3] · **Sabrina Leonardt** [4] · **Florencia Rizzo** [1]

Abstract In spite of its importance for rock art studies, rock art motifs coding and classification process is not always made explicit. In this discussion of the process of rock art classification, we consider an exploratory research employing two different criteria for the coding of a northwestern Patagonian rock art motifs database. One coding makes use of a 'lumping' criterion, and the other uses a 'splitting' criterion. Each of these criteria will be evaluated using cladistic analysis, recording how each coding criterion affects results. As a conclusion, and given our results, the use of more than one coding criterion is suggested when classifying rock art.

Keywords Rock art · Patagonia · Classification · Coding

Introduction

The normal procedure in the study of a rock art site "consists in identifying the assemblage of figures at a site, recording their shape and color in words, by photography or tracing, counting the number of figures, and deducing the technique by which

✉ Vivian Scheinsohn
scheinso@retina.ar

[1] Instituto Nacional de Antropología y Pensamiento Latinoamericano INAPL/Consejo Nacional de Investigaciones Científicas y Técnicas CONICET, 3 de Febrero 1370, Buenos Aires, Argentina

[2] Facultad de Filosofía y Letras, Universidad de Buenos Aires (UBA), Puán 470, Buenos Aires, Argentina

[3] Instituto Superior de Entomología INSUE/Consejo Nacional de Investigaciones Científicas y Técnicas CONICET, Miguel Lillo 205, Tucumán, Argentina

[4] Unidad Académica Río Gallegos, Universidad Nacional de la Patagonia Austral UARG-UNPA/ Consejo Nacional de Investigaciones Científicas y Técnicas CONICET, Lisandro de la Torre 1070, Santa Cruz, Argentina

Published online: 03 May 2015

they were made (…). Figures are then categorized into motifs (…). Once motif types have been derived a number of further steps can be taken" according to the researchers' objectives and criteria (Layton 1992: 7). In spite of its importance for rock art studies (Whitley 2005), rock art motifs coding and classification process is not always made explicit. Its main goal in rock art was the establishment of styles or cultural traditions (e.g., Chippindale 2001; Francis 2001; Whitley 2001; Domingo Sanz and Fiore 2014). However, few researchers—as those cited by Francis (2001), Layton (1992), and Muzzolini (2006)—explain their classification process. In this paper, we will analyze how this classification process works and how the criteria and scale of hierarchy applied by the researcher to code and define motif types may influence the results. For this purpose, we will appeal to a northwestern Patagonian (Fig. 1) rock art motif types database (Scheinsohn and Szumik 2007; Scheinsohn *et al.* 2009, 2011a), with the goal to evaluate the role of our study area, named Río Pico (Argentina)/Lago Verde (Chile, see location in Fig. 1, RP/LV henceforth), in the whole region.

We assume that the process leading to the distribution of motifs in the landscape, in an ethnographical context, is as follows: (1) someone paints a motif on one site; (2) that

Fig. 1 Map with the areas mentioned in the text

very same person or another one stores that motif in his/her memory and reproduces it at the same site or elsewhere; (3) there, it is seen by others who repeat this process for days, years, and /or centuries. Some motifs will not be reproduced, while others will be spread over a wide area, depending on cultural transmission processes (Boyd and Richerson 1985; Richerson and Boyd 2005). This model allows us to state that, if a site shares a motif type with another, we can establish an information link between them. This link could be in terms not only of space but also of time. At a regional level, motif types shared among sites allow linking them in terms of information flow (Scheinsohn and Caridi 2015).

Paraphrasing White's statement about artifacts, the spatial distribution of rock art motifs can be viewed as the material residues of "spatially-situated, network-mediated systems of social learning and information exchange" (White 2013: 1). They do not mirror the systemic (*sensu* Schiffer 1972) network since they are affected by taphonomic processes, sampling strategies, visibility problems, etc. But they signal the path that information has followed in time and space, an "archaeological cultural transmission path" (see Scheinsohn and Caridi 2015) settled in the landscape.

In previous works (Scheinsohn and Szumik 2007; Scheinsohn *et al.* 2009, 2011a), we have hypothesized that closer sites and areas would share more motif types than remote sites and areas. This hypothesis was supported on the assumption mentioned above since, following a simple diffusion model, a motif is more likely to be replicated (and with more fidelity) in its surroundings than far from it. So we expected that rock art motif types present in RP/LV would be shared mainly in neighboring areas (Parque Nacional Los Alerces and Rio Mayo/Guenguel in Fig. 1) and not in the ones located further. But this expectative was not accomplished (Scheinsohn *et al.* 2009). In evaluating the results, we began to assess the influence of the hierarchical classification utilized. As we had considered a classification of motif types based on a lumping criterion (which tends to homogenize rather than differentiate, see below), in this paper, we will evaluate the use of a splitting criterion (which tends to differentiate rather than homogenize).

Hierarchical Classification and Rock Art

In archaeological literature, the classification process is considered "(…) an extension of the recognition of differences and similarities among phenomena. Those materials, events or processes that are more similar than different, according to the classifier, are placed together into classes" (Hill and Evans 1972: 232). Dunnell (1977: 58) proposes that classification is an ordering in the ideational realm defined as the creation of units of meaning by means of redundancy (classes) in order to create methodologically meaningful analytical units. Dunnell differentiates classification from grouping, which occurs in the phenomenological [1] realm, and is defined as the creation of units of things (groups).These are mutually articulated through the identification process whereby classes are utilized in assigning phenomena to groups (Dunnell 1977).

[1] Ideational and Phenomenological realms are the terms employed by Dunnell (1977), and we use them in this sense. "Phenomenological" should not be confused with "Phenomenology," defined as the philosophical study of the structures of experience and consciousness (see note 2)

But beyond pointing out similarities and differences, classification can also be used to synthesize information. If the number of possible classes were equal to the number of cases or elements to be classified, there would be no difference between classification and the phenomena themselves. As Dunnell (1977) pointed out, classification focuses on redundancies in order to stress what is relevant for research and reduce the noise of the superfluous: classification provides the inner means to reduce reality to a manageable number of classes.

This function is particularly evident in the case of hierarchical classifications. In the case of biological classifications, for instance, following an example taken from Farris (1979), if X is a *Mus* (the genus mice belong to), when describing X it is only necessary to mention that it is a member of the *Mus* genus and to list the traits that distinguish X from another *Mus*. The *Mus* diagnosis will take care of the remainder. In turn, the *Mus* description can be synthesized using the position of *Mus* within the Muridae and placing these in Rodentia. The hierarchical classification then allows expression of information with economy of symbols or codes. In an archaeological case, if X is considered as a projectile point, when describing X, it is only necessary to mention that is a member of the projectile point class and list the traits that distinguish it from other projectile points (for instance, if it is stemmed or not).

In hierarchical or nested classification, there exist infinite levels at which classifications can be established, from one extreme, at which the quantity of classes equals the quantity of phenomena, to the other, at which a classification comprises a single class. Though each extreme can hardly be considered a classification, the systems of units located between these two extremes may fully be considered as such. Thus, in order to create a hierarchical classification, the first step must be the selection of a scale on which to establish the classes (Dunnell 1977). But how can we determine the appropriate scale?

Theoretical and Methodological Issues

When a rock art figure is recorded in a rocky surface ('phenomenological domain' *sensu* Dunnell 1977 see above), it is identified (Dunnell 1977) or diagnosed (Farris 1979) in terms of similarity with a motif type or class ('ideational domain'[2] *sensu* Dunnell 1977 see above). This diagnosis consists in establishing a description and a certain range of variation in a series of similar figures. In this way, for instance, we diagnose as a 'circle' a figure that can be approximately identified as such within a range of variation exceeding which it will be identified as another motif (e.g., an oval or a square motif). This motif is then assigned a value within that range of variation (which can be represented as a 0, X, or any other symbol). The question is: What degree of 'deformation' the operator can stand before he or she begins to consider this figure as an 'oval' and not a 'circle'? The process by which this is established is called 'coding', a step so incorporated that its existence is seldom acknowledged. If coding (including its variation range) is not made explicit, it is difficult to interpret any results.

[2] We consider the motif type (ideational domain *sensu* Dunnell 1977) as a class with a certain range of variation, meaning it has a typological content. We define figure as in the IFRAO Glossary (http://home.vicnet.net.au/~auranet/glossar/web/glossary.html in the phenomenological domain *sensu* Dunnell 1977).

It is not suggested here that everyone should adopt the same kind of coding, but that the criteria employed should be made clear in each classification produced (e.g., Scheinsohn *et al.* 2009 Appendix).

In this paper, the term ‘coding’ refers to the criteria employed to assign a certain figure, image, or representation (‘phenomenological realm’ *sensu* Dunnell 1977) to a motif type or class and assign it a state of attribute. We use ‘classification’ for the process in which motifs are defined as classes (in the ‘ideational realm’ *sensu* Dunnell 1977) and thereby permits the establishment of links among sites (Fig. 2).

Coding has its own problems. For instance, any description or identification implies a certain degree of interpretation. This is an important issue in rock art. When no illustrations were recorded and only narrated descriptions of figures or motifs were published (as it was the case in times when printing images was expensive), they could be interpreted in diverse ways by different readers. Also, it can be seen that the same motif (as for the illustrations) is interpreted even in opposite ways, and accordingly, they are described differently. Sometimes, researchers resort to geometrical elements for their description, in order to abide by criteria considered more objective, and other times, they consider a certain motif as the representation of some living or mythological being, involving a wider inferential leap. For example, in the Patagonian rock art literature, this happens when a single figure is considered either as an “irradiated circumference” or as a “sun” (Aschero 1983: 77; also Whitley 2005: 45).

It is true that certain degree of subjectivity seems unavoidable in rock art classification. In order to minimize it, some attempts have been made with automatic classification (i.e., Zhu and Keogh 2010). But here, visual image retrieval problems arise. As Zhu and Keogh (2010) stated, it is difficult to extract automatic data from rock art images since the resulting dataset is both heterogeneous and noisy. CAPTCHAs (puzzles designed to tell humans and computers apart) have been used to segment and index rock art. By experimenting with human drawing based on actual photographs of petroglyphs and considering the whole variation obtained, they have arrived at good results (Zhu and Keogh 2010). The main benefit of that type of study is that the criteria employed in the coding and classification process must be made explicit. Facet Theory (Guttman and Greenbaum 1998), a theoretical framework developed in psychology,

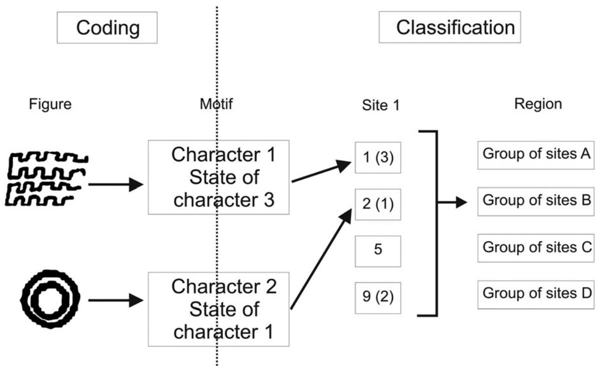


Fig. 2 Coding and classification process: Coding comprehends the analytical step that goes from the figure (*left of the graph*) to its assignation to a motif (class, *center of the graph*). Classification (*right of the graph*) goes from the motif (*center of the graph*) to the grouping of sites in a certain region following its motif representation (*right of the graph*)

could afford similar results. But still subjectivity could also arise from other sources not sufficiently explored yet. For instance, cross-cultural aspects and the underlying processes of cognitive representation implied are still underdeveloped in rock art studies.

Other critical issue, the one dealt with in this paper, is related to setting the scale of classification. Given three rock art figures—for example, a 'hollow circle', a 'filled-in circle', and a 'circle with embedded elements'—are they members of the same motif type with different states of attributes? Or do they represent different motif types? This is what we called a problem of "nestedness", and it is posed by the level at which rock art motif types are established or, differently put, the scale of admissible variation for codifying a given figure as one motif type (character) or a motif type attribute (state of character).

A single motif can be classified in different ways according to the scale at which motif types have been defined: Therefore, a figure that in one scale of low resolution would be just one motif type (which may have different states of characters or not), in another scale with higher resolution could be codified as many different motif types (characters). This issue was first analyzed in biological systematics, where lumping and splitting classifications were discussed (Simpson 1945). A lumper researcher considers a global vision of a definition and assigns individuals in a broad manner on the supposition that differences are not as important as similarities. A splitter researcher considers a precise definition and creates new categories whereby to classify individuals in different ways. This matter has been scantily discussed in archaeology (but see Atici *et al.* 2012), and it is related with what Loendorf (2001:61) has proposed for rock art element definition: "If several petroglyphs are found next to one another, it may be difficult to decide what constitutes an element. A row of dots could be considered a single element, or each dot could be considered an element in itself. This is the sort of problem classifiers fret about, wherein those who call each dot an element are *splitters* and those who call the group of dots an element are *lumpers*". We have added another dimension to the problem which is how the many versions of a certain image could be nested in the classification (Fig. 2). For instance, as said, we can consider any circle as a motif type with different states of character (hollow, filled in, etc.) as in the Fig. 3a where the character is 5 and the states of character are 1 to 13 (1 character with 13 states of character), or we can consider different kinds of circle as different motif types as in Fig. 3b where there are 7 characters (8 to 14), each one with their own states.

Nestedeness: An Archaeological Experimental Approach

We have set the experimental work dealt with in this paper as a way to determine how "nestedness" affects the results obtained and how to assess the appropriate scale. If rock art motif types' distribution can reflect the information flow between human groups (see, among others, Hartley 1992; Aschero 1996; Bellelli *et al.* 2008; McDonald 2008; Carden 2009; Re *et al.* 2009; Scheinsohn 2011), then identifying areas with shared motif types will allow us to trace networks among sites and areas. As our first assumption on geographical proximity was not verified in previous work, we began to wonder if our results were a product of the actual networks (in which geographical distance does not affect the information flow), or if they were an artifact of our coding criterion since, in those, we had employed a lumping classification (Scheinsohn and Szumik 2007; Scheinsohn *et al.* 2009, 2011a). A splitting classification would be able

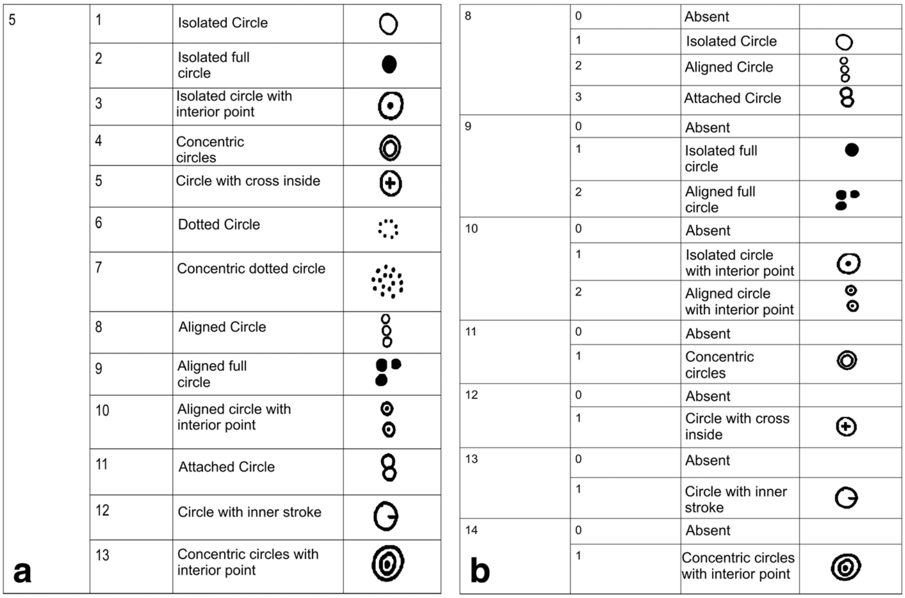


Fig. 3 **a** Example of circle motif (*5*) and states of character (*1* to *13*) under lumping criterion **b** Example of circle motif under splitter criterion. See different motif (*8* to *14*) and states of character (*0* to *3* depending on the case)

to detect fine-grained geographical variation and thus allow verifying the geographical proximity influence. In terms of our study area (RP/LV), this implies that its relationship with neighboring areas will vary depending on what "nestedness" we use for the classification of rock art motifs: A lumping classification, in being general and homogenous, will relate our area with many others no matter if they are close or far, while splitting classification will be more selective relating RP/LV with fewer areas and, following our first hypothesis, the closer ones.

Methods and Materials

Late Holocene in Patagonia

Patagonia is located at the very southern end of South America, and it is shared by Chile and Argentina. It has been populated at least since the Pleistocene/Holocene transition (Borrero 2001; Scheinsohn 2003). The Late Holocene (*c*. 5000 BP to the present) is characterized by notorious climatic and ecological changes that influenced Patagonian hunter-gatherers occupation (Borrero 2001). An increase in the demographic density of human populations in northern Patagonia has been argued on the basis of an increment in the quantity of archaeological sites (Borrero 2001; Barrientos 2002; Scheinsohn 2003; Barrientos and Perez 2004, among others). This process should be correlated with cases of restricted residential mobility and wide exchange networks, as demonstrated by obsidian distribution and other items exchanged with non-hunter neighbors (Scheinsohn 2003 among others). Related to this demographic density increase, it has been proposed that all the environments available in Patagonia (most of it steppe but also with a forest strip associated with the Cordillera de los Andes) were occupied (Borrero 2001). As a consequence, an increase in circulation of diverse types of artifacts between those environments was recorded (Bellelli *et al.* 2003, 2007; Podestá *et al.* 2007, among others).

Patagonian Fret Style

Late Holocene rock art sites are characterized by a style called *Estilo de Grecas* (or Fret style; Menghin 1957), also termed Complex Geometrical Abstract Trend (CGAT, Gradin 1999). This style spreads from south of Mendoza province down to 47°S, and from the Atlantic coast to beyond the Cordillera de los Andes (Belardi 2004; Podestá *et al.* 2007). The oldest dating corresponds to *c.* 1300 and 700 BP (Podestá *et al.* 2009), and it is characterized by rock art motifs made up of broken lines forming complex stepped-crenellated patterns (called *grecas* or frets) as labyrinths or maze motifs. They are accompanied by zigzags, circles, rhombuses, X-figures, crosses, tridents, squares, and other polygons (Gradin 1999). Fiore (2006) also considers under this same label, and as contemporaneous, portable supports (ceramics, leather, plaque, and stone axes) and different techniques as paintings and engravings.

Many interpretations have been postulated to explain the CGAT rock art style that, at its core, can be reduced to two opposing models (Scheinsohn 2011: 239): (1) The broad-scale model posits that the CGAT style reflects a wide interaction network at a macroregional level, with no internal differentiation; (2) The territorial model posits that CGAT reflects territorial circumscription and ethnic differentiation in the context of incremental increases in population density, territorial size, or home range reduction. Our previous results in the region rejected the hypothesis that rock art could be interpreted in terms of territorial marking (Scheinsohn *et al.* 2009; Scheinsohn 2011). Instead, the scenario we have envisioned for Northwestern Patagonia in Late Holocene times is that of a low-density population trying to maintain links between different places located in two different biomes: the steppe and the forest. The latter seems to be incorporated in a more continuous basis to hunter–gatherers mobility patterns in the last 3,000 years. In this process, rock art could have been part of the colonizing social repertoire of the forest, allowing that shared graphics will be present across thousands of kilometers in a similar situation as the one proposed by McDonald and Veth (2011) for the initial settlement of the arid zone of Australia and by McDonald (2008) for later moments in Sydney region. The establishment and maintenance of regional social ties has been recognized as an important part of hunter–gatherer adaptations to uncertain environments in terms of creating a "safety net" of contacts and relations that can be critical to survival (Whallon 2006). The broad scale model is coherent with a situation in which rock art could be playing such a role for hunter–gatherers in the Northwestern Patagonian forest (Scheinsohn 2011).

Study Area

Our main research focus is RP/LV area, where we have conducted our investigations projects since 2009 (Scheinsohn *et al.* 2011b). The area is situated in northern Patagonia (Fig. 1). Four sites with rock art were recorded there: two in Chile (Lago Verde locality, studied by Chilean colleagues, see Reyes 2003) and two in Argentina (Solís 1 and Acevedo 1, studied by us). In the framework of this research project, we are trying to establish the role of the RP/LV area in NW Patagonian hunter–gatherer circulation patterns on the basis of the distribution of rock art motifs.

The sample used in Scheinsohn *et al.* (2011a) provided the starting point for the present work. We considered 49 sites, all of them rock-shelters containing pictographs, located in RP/LV and surrounding areas and extending from Neuquén province to the south of Chubut province, and from 70°W approximately to the Argentina–Chile border in the west (with the exception of Lago Verde sites located in Chile but only a few kilometers from the border; Fig. 1 and Table 1). Most of these sites were coded from information available in printed publications,[3] although we have primary data from some sites (Table 1). It should be noticed that, although we are analyzing most of the published sites, the whole universe of sites is unknown since it is a reasonable guess to think that there should be more rock art sites still undiscovered, especially in the forested part of the area, due to archaeological visibility problems (Scheinsohn 2011; Scheinsohn and Matteucci 2013).

Coding and Classification

Figures were coded following both a lumping coding utilized in Scheinsohn *et al.* (2009; using in all 60 motif types) and a new splitting coding (totaling 126 motif types, Scheinsohn *et al.* 2013), both departing from the same 49 archaeological sites database. Following these two coding criteria, and by means of a classificatory technique, we sought to check the differences and similarities between the areas linked in the results.

As a classificatory technique for the sites we employed cladistics,[4] a methodology normally used in phylogenetic reconstruction in biology. Since here we wanted to test the coding criteria (and not vertical or horizontal transmission, which will be the focus of a specific paper), similar results may be obtained using cluster analyses or other procedures as long as it remained as a constant and used with the same parameters for both coding criteria. For both lumping and splitting processes, searches of maximally parsimonious trees were performed using the TNT 1.1 program (Goloboff *et al.* 2008), and a fictitious root was established consisting in an absent state for all motif characters or types (state 0). The heuristic method depicted by Goloboff (1999) was used to search optimal trees (cladograms). The analysis stops when the minimum length (parsimonious tree) was hit 20 times, each of them in an independent replication.

In applying this methodology, each site was considered as equivalent to a "species" and each motif type as a "character" that may or may not be present in those "species"/sites and could have different attributes or states. Thus, the "species" (sites) were defined in terms of the presence/absence of each "character" (motif type). This allows a measure of similarity since a "species" (site) is equal to the other in terms of the characters they share. Coding

[3] In the past, Patagonian rock art databases were not fully published in view of space limitations imposed by printed publications, so the results were presented in a synthetic way. In most works, the whole site rock art repertoire is unknown, and only some types of motifs that stood out for some particular reason were described and/or illustrated.

[4] Cladistic systematics seeks to explain the maximum of characteristics shared by certain organisms due to common ancestrality, which is known as the parsimony principle (Goloboff 1999). This is achieved by means of a hierarchical grouping of those taxa sharing the greatest quantity of derived characters and is expressed by means of a cladogram or tree. However, under a biogeographical perspective, cladistics allows for the obtaining of clades with which it is not expected to determine ancestrality but spatial patterns instead (Nelson and Platnick 1981; Humphries and Parenti 1986).

Table 1 Sites grouped by areas and type of data source and reference

Area	Archaeological sites	Abbreviation	Data source
Lago Lácar	Catritre	–	Albornoz and Cúneo (2000)
	Quila Quina	–	Silveira and Fernández (1991)
	Curruhuinca 1	–	Silveira and Fernández (1991)
Traful	Alero Las Mellizas	Las Mellizas	Silveira and Fernández (1991)
	Alero Los Cipreses	Los Cipreses	Silveira and Fernández (1991), Silveira (1996)
	Alero Lariviere	Lariviere	Silveira (1988–89, 1999) Silveira and Fernández (1991)
	Pintura del Arroyo Minero	Arroyo Minero	Pedersen (1978)
Pilcaniyeu	Cueva Sarita 3	Sarita 3	Boschín (2000, 2009)
	Cueva Sarita 4	Sarita 4	Boschín (2000, 2009)
	Cueva Comallo 1	Comallo 1	Boschín (2000, 2009)
	La Figura 1	Figura 1	Boschín (2000, 2009)
	Paredones del río Pichileufu	Pare. Pichileufu	Boschín (2000, 2009)
	Cueva Pulpulcurá 2	Pulpulcurá 2	Boschín (2000, 2009)
	Cueva 1 del río Pichileufu	C1. Pichileufu	Boschín (2000, 2009)
	Cueva Cuadro Leleque 1	CC. Leleque 1	Boschín (2000, 2009)
	Abrigo de Pilcaniyeu	Pilcaniyeu	Boschín (2000, 2009)
Nahuel Huapi and Río Limay	Cementerio del río Limay	Cem. Río Limay	Vignati (1944)
	Cerro Leones	–	Vignati (1944)
	Estancia Huemul	Est. Huemul	Vignati (1944)
	I V 2a Puerto Tranquilo Sección 17	IV2a Tranquilo	Pedersen (1978)
	LNH2 Naríz de Diablo 1	LNH2. N. Diablo	Pedersen (1978)
	LNH1 Puerto Tigre	LNH1. Tigre	Pedersen (1978)
	IV 4 Puerto Vargas	IV4 Vargas	Pedersen (1978)
	IV 3 al Norte de Puerto Vargas	IV3 Vargas	Pedersen (1978)
	El Trébol	–	Hajduk *et al.* (2004, 2009)
Comarca Andina del Paralelo 42 (CA 42)	Raimapu	–	Primary dataset
	Peñasco	–	Primary dataset
	Cerro Pintado	CP	Primary dataset
	Risco de Azócar1	RA1	Primary dataset
	Risco de Azócar 2	RA2	Primary dataset
	El Radal	–	Primary dataset
Río Manso	Paredón Lanfré	P. Lanfré	Primary dataset
	Peumayén 2	–	Podestá *et al.* (2009)
Piedra Parada	Campo Moncada 1	CM1	Aschero (1983), Onetto (1986–1987), Pérez de Micou (1979–1982)
	Campo Nassif 1	CN1	Aschero (1983), Onetto (1986–1987), Pérez de Micou (1979–1982)

Table 1 (continued)

Area	Archaeological sites	Abbreviation	Data source
	Piedra Parada 1	PP1	Aschero (1983), Onetto (1986–1987), Pérez de Micou (1979–1982)
	Piedra Parada 4	PP4	Aschero (1983), Onetto (1986–1987), Pérez de Micou (1979–1982)
	Campo Cretón 1	C. Cretón 1	Aschero (1983), Onetto (1986–1987), Pérez de Micou (1979–1982)
Parque Nacional Los Alerces	Alero Sendero de Interpretación	Ale. Interpret.	Arrigoni (1997) Arrigoni and Fernández (2004)
	Alero del Shaman	Shaman	Arrigoni (1997) Arrigoni and Fernández (2004)
Río Pico/Lago Verde (RP/LV)	Acevedo 1	–	Primary dataset
	Solís 1	–	Primary dataset
	Lago Verde 1	L. Verde 1	Reyes 2003
	Lago Verde 2	L. Verde 2	Reyes 2003
Río Mayo/Guenguel	Guenguel	–	Pérez de Micou *et al.* (2009)
	Manantiales 1	Manant. 1	Pérez de Micou *et al.* (2009)
	Manantiales 2	Manant. 2	Pérez de Micou *et al.* (2009)
	Viejo Corral	V. Corral	Pérez de Micou *et al.* (2009)
	Bardas Blancas	B. Blancas	Pérez de Micou *et al.* (2009)

was carried out by defining different attributes on the basis of morphological aspects of the figures found at each site, considering only the painted ones, since in the area engravings are scarce (Fiore 2006), so they were left aside in order to avoid 'noise' due to issues related with the manufacture technique. In order to minimize the degree of subjectivity in the process of assigning a figure to a motif type and the codification of each state of character, each figure underwent inter-subjective testing involving three of the authors of this work. Every operator, separately, identified a figure, either from a description or illustration, with a motif type. It was verified if the figure was assigned to the same motif type by each operator. In case of disagreement (that is, that the same figure was assigned to different motif types by different operators), the figure was identified by the majority.

For separating states of a character, in the case of the coding carried out according to a lumping criterion (Scheinsohn *et al.* 2009, 2011a), each motif type was considered as possessing several state of characters, which would be the admissible range of variation within a certain morphology. For example, the 'circle' motif type (character 5, see Fig. 3a) included all those figures described by a circle, with 13 attribute states being distinguished, among which are 'isolated circles', 'hollow circles', 'circles with embedded elements', or their spatial disposition (in groups, aligned, etc.). In this way, all the "versions" of the 'circle' motif have the same hierarchy: a state of character (Scheinsohn *et al.* 2009).

In the second case, using the 'splitter' criterion, each character came out as an independent motif, and only attributes related to the spatial disposition of the motif (isolated, in groups, lines, etc.) were considered as states. Out of the 13 states composing the 'circle' motif type in lumping coding, seven motif characters were defined (characters 8 to 14), if absent this motif was coded as 0 and if present was coded as 1 (single) and 2, 3, or 4 according to its spatial disposition (Fig. 3b).

After performing these steps, we obtained one strict consensus tree (to summarize the optimal trees obtained) for each coding set. We would then compare both, looking for relationships between RP/LV and the rest of the areas.

Results

Figure 4 shows the lumping criterion consensus tree and Fig. 5, the splitting criterion consensus tree. Comparison of the two figures shows that, in each case, few sites[5] are grouped by geographical proximity.

In Fig. 4, RP/LV area appears distributed in two groups. In the first, the site Solís 1 stands alone. The other three sites (Acevedo 1, Lago Verde 1, and Lago Verde 2) and sites in the Piedra Parada, Pilcaniyeu, Traful, Nahuel Huapi, and Los Alerces areas are linked together.

In the second tree (Fig. 5), the RP/LV area appears distributed among three groups. Lago Verde 2 site can be found alone. Solís 1 site makes up a second clade along with Lago Verde 1 and the third links Acevedo 1 with sites of Piedra Parada, Traful, Pilcaniyeu areas, and sites of Comarca Andina del Paralelo 42° (CA42°). In other words, Solís 1, Lago Verde 1 and 2 sites, all within the same area, are related to one another whereas Acevedo 1 is the only that relates with neighboring areas. It is necessary to remark that this may only be a sample size effect, since Acevedo 1 has more motif types (14 and 13 motif types by lumping and splitting criteria respectively) than the other sites (Solís 1 has 5, LV1 has 4, and LV 2 has two regardless of the criterion employed).

Since the topology of these trees is different, we decided to produce an agreement 'sub-tree' (Fig. 6), which consists in identifying, in all the trees, the subgroup with an identical relationship (Goloboff *et al.* 2008). This is a measure of similarity between both trees and is obtained by "pruning" sites until a sub-tree is obtained. In this way, it was possible to ascertain that both trees have only 15 sites or "species" in common out of the 49 making up the database. Notably, part of that agreement sub-tree includes two sites from the RP/LV area (Lago Verde 2 and Acevedo 1, Fig. 6), only the latter related to Traful and Pilcaniyeu areas.

Discussion

Results show that, even applying splitting classification, the geographical proximity assumption is not verified. The lack of geographical linking with closer areas could be a

[5] (a) sites Pilcaniyeu, C1_Pichileufu, and Pare_Pichileufu (area denominated Pilcaniyeu in Table 1 see also Fig. 2), (b) Est_Huemul and Cem_rio_Limay (area denominated Nahuel Huapi and Río Limay in Table 1; see also Fig. 2), (c) PP4 and CN1 (located in the area denominated Piedra Parada in Table 1 see also Fig. 2), (d) Manant_1 and B_Blancas (area denominated Río Mayo/Guenguel in Table 1; see also Fig. 2), (e) L_Verde_1 and L_Verde_2 (area denominated Río Pico/Lago Verde in Table 1 see also Fig. 2). All these exceptions correspond to no more than three sites and always accompanied in the same clade by others sites in other areas or far away.

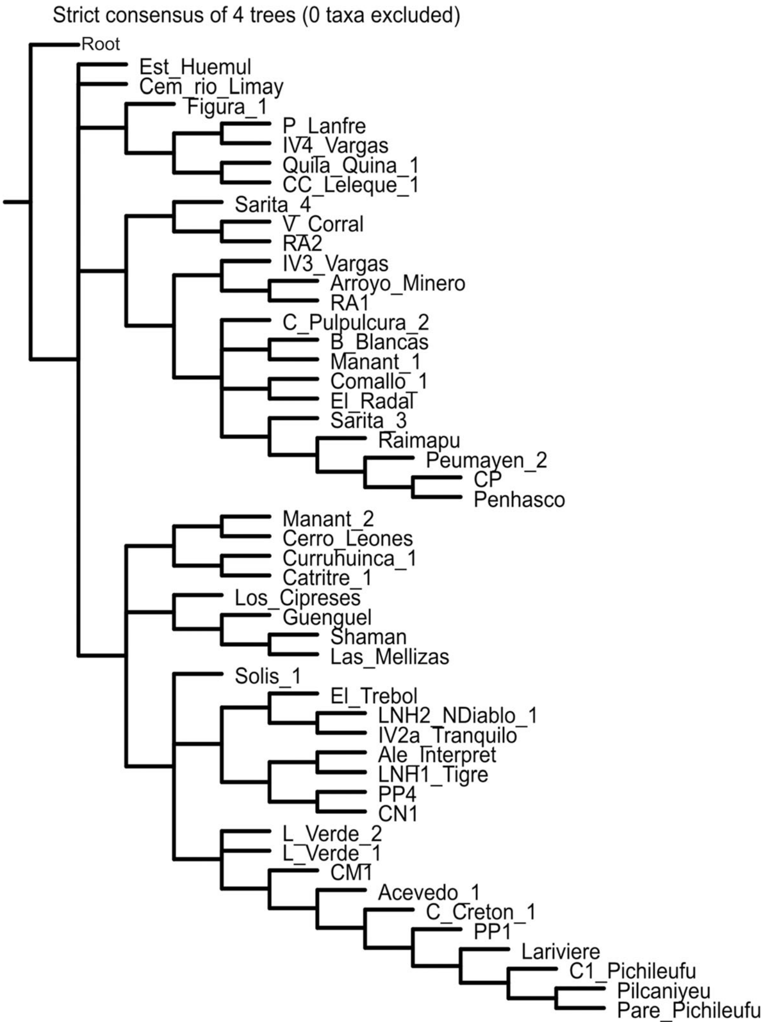


Fig. 4 Consensus tree under lumping criterion

characteristic of the actual information network instead of an artifact of the classification criteria used. It must be taken into account that time is considered here as a coarse-grained dimension, since we are treating as contemporaneous sites that could be included in a 2,000-year span. What is considered as a single network could include sites that are actually diachronic. Since the generalized lack of organic content in pigments utilized in NW Patagonia precludes its radiocarbon dating (see, for example, Podestá and Tropea 2010 for Comarca Andina del Paralelo 42°), the temporal dimension cannot be currently controlled.

Results allowed identifying differences in terms of the topology of RP/LV area. While the two trees do not show many common elements, the fact that at least two sites in the RP/LV area should be part of the agreement sub-tree and linked with Traful and Pilcaniyeu, strengthens the possibility of an informational flow between these areas (being in space or in time or both). In the case of the lumping coding (Fig. 3), the RP/LV

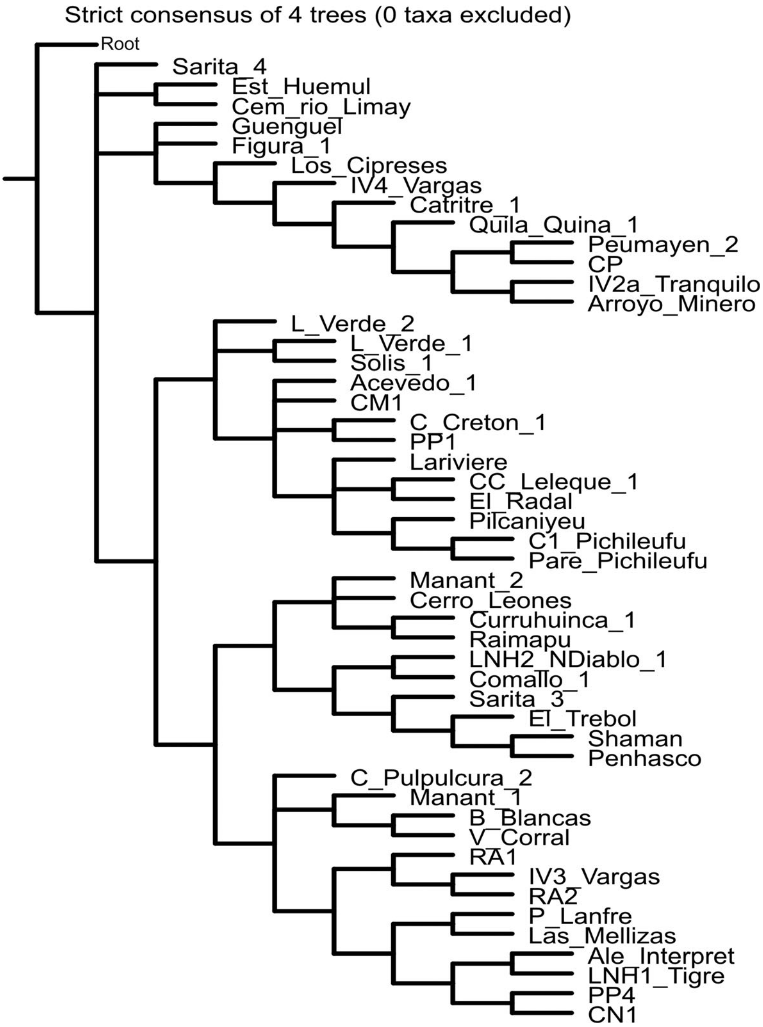


Fig. 5 Consensus tree under splitting criterion

area is grouped with those of Piedra Parada, Traful, Pilcaniyeu, Nahuel Huapi, and Los Alerces. On the other hand, while the splitting coding (Fig. 4) includes the first three, it

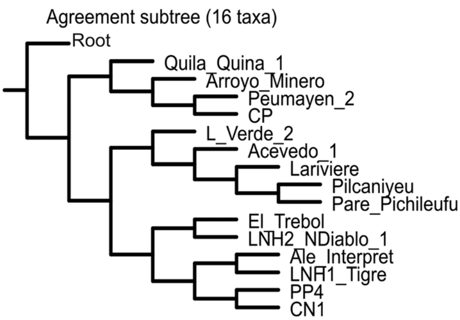


Fig. 6 Agreement sub-tree

excludes Nahuel Huapi and Los Alerces and adds CA42°. Then, a "Northern connection" is verified (Piedra Parada, Traful, Pilcaniyeu), and the regions geographically close to RP/LV are included or not depending on the classification criterion utilized. Actually, contrary to expected, closer regions are included only with the lumping coding.

How can we interpret this "Northern connection"? It is difficult to interpret it in terms of ethnic content. This is also true for the Fret style itself. As Whitley points out "There is no compelling a priori reason to equate rock art styles with cultural historical studies, implying specific time periods and ethnic groups. Indeed, ethnographic research has shown that art styles in general may pertain to tribes, broad regions and cross-cut tribal boundaries, particular crafts or media, specific ritual groups, longer or shorter time periods, initiatory cults, the sexual division of labor and so on (…). Rock art styles alone are not, in other words, indicative of a particular cultural group or time period, though many rock art studies have made that assumption" (Whitley 2005: 48–49). Then, Fret style should not be equated with a single ethnic group since it could cross-cut ethnic boundaries. But we can also find that differences could occur within a single group, and this can account for stylistic differences and/or motif sharing, as was recorded ethnographically by Whitley (2005, 2011, and 2014) for Californian Native groups. Instead, what we are arguing here is that the Northern connection reflects an "archaeological cultural transmission path" (Scheinsohn and Caridi 2015; see above).

Conclusion

In this paper, we tested the possibility that coding criteria could influence our results avoiding the identification of links between close areas. Our results suggest that motifs shared among sites are independent of geographical proximity no matter which coding approach we use. The network conformed by sites sharing a motif type could also have a temporal content (Scheinsohn and Caridi 2015) since, as time goes by, motifs can circulate farther away. In the case presented here, although the coding criteria do influence the location of RP/LV sites in the different trees obtained, our results suggest that RP/LV area is strongly associated with Pilcaniyeu and Traful, regardless of the kind of coding we use. Consequently, the results obtained strengthen the proposition of an "archaeological cultural transmission path" between those areas.

Nevertheless, we cannot assume that all the cases are as ours, where a strong association exists. There are many sources of variation that affect the "nestedness" hierarchy chosen for classifying motifs and sites. One of those sources is the emic–etic distinction. As Whitley states, "Whether circles and dots had the same iconographic value for the original artist or whether they symbolized entirely different things may be difficult to determine. It is often easier initially to distinguish each if these different geometric patterns as distinct motif types—to split them up—and then look to independent theory or evidence to guide the final classification, which might require regrouping some of them into a single type." (Whitley 2005: 44-45). In this case, Whitley stresses the relationship between the emic and the etic classification. Another source of variation arises from the etic classification alone. For instance, following a lumping criterion, if we consider only the presence of a single circle motif type (as in Fig. 3a), this will lead to expect that sites with different types of circles will be classified under the same category, homogenizing the sample and not allowing variability to emerge. On the contrary, following a splitter criterion (as in Fig. 3b), the site classification will deliver heterogeneity, being difficult to evaluate similarities between sites. Both types of classification could be useful depending on our goals. Since, in this case, there is not an independent theory that allows us to make a decision; we have experimentally worked with both criteria in order to assess the hierarchical scale to employ. Our results suggest that, without an independent theory guiding us, what is recommendable is to explore the effects of different coding criteria (lumping or splitting) upon different hierarchical scales, since the results could differ. The concordances obtained reinforce relationships detected among distant areas, but it would be dangerous to discard the consideration of other areas that simply went undetected due to the coding criteria used.

We regret that we could not have access to the primary databases of most of the sites we studied, since it is possible that this limitation generated biases for which we cannot fully account. Nevertheless, to restrict ourselves only to primary data would take us to consider a very small sample (Table 1) with other consequent biases. Also, some sites considered in our sample are only accessible through its publication since today many of them are destroyed or severely deteriorated. Hopefully, new possibilities of scientific interchange made possible by use of the Internet would allow us access to primary data produced by other researchers, replication of results, and the generation of new perspectives and hypotheses. In the meantime the processes of coding and classification should stop being a "hidden" step in rock art studies and make it explicit in order to obtain profitable results.

Acknowledgments This work was supported by Universidad de Buenos Aires (UBA), Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), and Agencia Nacional de Promoción Científica y Tecnológica (ANPCYT) grants.

We want to acknowledge the valuable suggestions made by the three anonymous reviewers which certainly improved our paper. We are also grateful to Dánae Fiore, Luis Borrero, Pablo Goloboff, and Graeme Ward, who kindly made thoughtful suggestions and improvements to a previous version of this paper.

We thank Omar Reyes and César Méndez for having put at our disposal the Lago Verde 1 and 2 sites locational data. Our thanks go to the inhabitants of Río Pico, especially the Municipality, to the town mayor Adrián Gago and Mr. José Francisco Solís. We especially wish to thank the Acevedo family (José, Carlos, Diego, and Victoria) and the staff of Río Pico Secondary School No. 783: Adriana Giannina, its headmistress, Ariel López, deputy headmaster and its teachers, particularly Guadalupe Guillermo, Florencia Andolfatti, and Andrés Chaloupka. Also Gendarmería Nacional (National Border Guard) and specially Principal Commander Insaurralde, Chief of Squadron 37 at José de San Martín locality (Chubut), for providing us with transport for our field work. We are grateful to Adrián Guillaume for helping us to obtain permits to work in Chubut province. Our gratitude goes also to Mercedes Podestá who generously provided us with her primary data on the sites of the Comarca Andina del Paralelo 42, as well as Cristina Bellelli, Pablo Fernández, and Mariana Carballido, members of the same research team. We are also grateful to Natalia Carden, Analía Castro, and David Whitley for kindly facilitating the bibliography we needed. We thank the Instituto Nacional de Antropología y Pensamiento Latinoamericano (INAPL) and its staff for all the help provided. We acknowledge our debt of gratitude to the Willi Hennig Society for having given us free access to the TNT program. We are grateful for the comments and criticism received at the presentation of previous versions of this work at the X Reunión Argentina de Cladística y Biogeografía (10th Argentine Meeting on Cladistics and Biogeography Mendoza, 2012) and the 2013 IFRAO Congress (Albuquerque, USA). Also we acknowledge Julia Benseñor for the final translation review and Ana Fondebrider for the Figure 1 map. Funding was provided by ANPCYT PICT 2010 Nº 1810, The final responsibility is ours.

References

Albornoz, A. M., & Cúneo, E. M. (2000). Análisis comparativo de sitios con pictografías en ambientes lacustres boscosos de Patagonia Septentrional: lagos Lácar y Nahuel Huapi (provincias de Neuquén y Río

Negro). In M. M. Podestá & M. de Hoyos (Eds.), *Arte en las Rocas. Arte rupestre, menhires y piedras de colores en Argentina* (pp. 163–174). Buenos Aires: Sociedad Argentina de Antropología- Asociación Amigos del INAPL.

Arrigoni, G. (1997). Pintando entre lagos y bosques (las pinturas rupestres del Parque Nacional Los Alerces, Chubut). *Revista del Museo de Historia Natural de San Rafael, 16*(1-4), 241–259.

Arrigoni, G., & Fernández, P. (2004). Los restos óseos de alero del Sendero de Interpretación (PN Los Alerces, prov. del Chubut): integridad, resolución y aprovechamiento de los recursos faunísticos del bosque. In M. T. Civalero, P. M. Fernández, & A. G. Guráieb (Eds.), *Contra viento y marea. Arqueología de Patagonia* (pp. 403–416). Buenos Aires: Instituto Nacional de Antropología y Pensamiento Latinoamericano—Sociedad Argentina de Antropología.

Aschero, C. (1983). Sitio San Ramón 1 (SR1). In C. Aschero, C. Pérez de Micou, M. Onetto, C. Bellelli, L. Nacuzzi, & A. Fischer (Eds.), *Arqueología del Chubut. El valle de Piedra Parada* (pp. 77–78). Rawson: Gobierno de la Provincia de Chubut.

Aschero, C. (1996). ¿Adónde van esos guanacos? In J. Gómez Otero (Ed.), *Arqueología. Solo Patagonia. Ponencias de las II Jornadas de Arqueología de la Patagonia* (pp. 153–152). Puerto Madryn: Centro Nacional Patagónico.

Atici, L., Kansa, S. W., Lev-Tov, J., & Kansa, E. C. (2012). Other people's data: a demonstration of the imperative of publishing primary data. *Journal of Archaeological Method and Theory, 1*(3), 1–19.

Barrientos, G. (2002). The archaeological analysis of death-related behaviors from an evolutionary perspective: exploring the bioarchaeological record of early American hunter-gatherers. In J. L. Lanata & G. Martínez (Eds.), *Perspectivas integradoras entre arqueología y evolución. Teoría, método y casos de aplicación. Serie Teórica N°1* (pp. 221–253). Olavarría: Universidad Nacional del Centro de la Provincia de Buenos Aires.

Barrientos, G., & Perez, I. S. (2004). La expansión y dispersión de poblaciones del norte de Patagonia durante el Holoceno tardío: evidencia arqueológica y modelo explicativo. In M. T. Civalero, P. M. Fernández, & A. G. Guráieb (Eds.), *Contra viento y marea. Arqueología de Patagonia* (pp. 179–195). Buenos Aires: Instituto Nacional de Antropología y Pensamiento Latinoamericano-Sociedad Argentina de Antropología.

Belardi, J. B. (2004). Más vueltas que una greca. In M. T. Civalero, P. M. Fernández, & A. G. Guráieb (Eds.), *Contra viento y marea. Arqueología de Patagonia* (pp. 591–603). Buenos Aires: Instituto Nacional de Antropología y Pensamiento Latinoamericano–Sociedad Argentina de Antropología.

Bellelli, C., Carballido Calatayud, M., Fernández, P. M., & Scheinsohn, V. (2003). El pasado entre las hojas. Nueva información arqueológica del noroeste de la provincia de Chubut, Argentina. *Werken, 4*, 25–42.

Bellelli, C., Carballido Calatayud, M., Fernández, P. M., & Scheinsohn, V. (2007). Investigaciones arqueológicas en el valle del río Manso inferior (Pcia. de Río Negro). In Actas del XVI Congreso Nacional de Arqueología Argentina, tome 3 (pp. 309–314). San Salvador de Jujuy: Universidad Nacional de Jujuy.

Bellelli, C., Scheinsohn, V., & Podestá, M. M. (2008). Arqueología de pasos cordilleranos: un caso de estudio en Patagonia Norte durante el Holoceno tardío. *Boletín del Museo Chileno de Arte Precolombino, 13*(2), 37–55.

Borrero, L. A. (2001). *El poblamiento de la Patagonia. Toldos, milodones y volcanes*. Buenos Aires: Emecé.

Boschín, M. T. (2000). Sociedades cazadoras del área Pilcaniyeu, sudoeste de Río Negro: elementos para un análisis territorial. *Mundo Ameghiniano, 14*, 1–75.

Boschín, M. T. (2009). Tierra de hechiceros. Arte indígena de la Patagonia septentrional argentina. Salamanca: Ediciones Universidad de Salamanca. Servicio de publicaciones de la Universidad de Córdoba.

Boyd, R., & Richerson, P. J. (1985). *Culture and the evolutionary process*. Chicago: University of Chicago Press.

Carden, N. (2009). *Imágenes a través del tiempo. Arte rupestre y construcción social del paisaje en la Meseta Central de Santa Cruz*. Buenos Aires: Sociedad Argentina de Antropología.

Chippindale, C. (2001). Studying Ancient Pictures as Pictures. In D. Whitley (Ed.), *Handbook of rock art research* (pp. 247–272). Oxford: Altamira Press.

Domingo Sanz, I., & Fiore, D. (2014). Style: Its role in the archaeology of Art. In C. Smith (Ed.), *Encyclopedia of global archaeology* (pp. 7104–7111). New York: Springer.

Dunnell, R. C. (1977). *Prehistoria moderna. Introducción sistemática al estudio de la arqueología prehistórica*. Madrid: Istmo.

Farris, J. (1979). The information content of the phylogenetic system. *Systematic Zoology, 28*(4), 483–519.

Fiore, D. (2006). Poblamiento de imágenes: Arte rupestre y colonización de la Patagonia. Variabilidad y ritmos de cambio en tiempo y espacio. In D. Fiore & M. M. Podestá (Eds.), *Tramas en la piedra. Producción y usos del arte rupestre* (pp. 43–62). Buenos Aires: World Archaeological Congress, Asociación Amigos de Instituto Nacional de Antropología, Sociedad Argentina de Antropología.

Francis, J. E. (2001). Style and classification. In D. Whitley (Ed.), *Handbook of rock art research* (pp. 221–244). Oxford: Altamira Press.
Goloboff, P. (1999). Analyzing large data sets in reasonable times: solutions for composite optima. *Cladistics, 15*, 415–428.
Goloboff, P., Farris, J., & Nixon, K. (2008). TNT, a free program for phylogenetic analysis. *Cladistics, 24*, 774–786.
Gradin, C. (1999). Sobre las tendencias del arte rupestre de Patagonia argentina. In M. Tamagnini (Ed.), *Segundas Jornadas de Investigadores en Arqueología y Etnohistoria del Centro-Oeste del País* (pp. 85–99). Córdoba: Universidad Nacional de Río Cuarto.
Guttman, R., & Greenbaum, C. W. (1998). Facet theory: its development and current status. *European Psychologist, 3*(1), 13–36.
Hajduk, A., Albornoz, A., & Lezcano, M. (2004). El "mylodon" en el patio de atrás. Informe preliminar sobre los trabajos en el sitio El Trébol, ejido urbano de San Carlos de Bariloche. Provincia de Río Negro. In M. T. Civalero, P. M. Fernández, & A. G. Guráieb (Eds.), *Contra viento y marea. Arqueología de Patagonia* (pp. 715–732). Buenos Aires: Instituto Nacional de Antropología y Pensamiento Latinoamericano - Sociedad Argentina de Antropología.
Hajduk, A., Albornoz, A., & Lezcano, M. (2009). Nuevas excavaciones en el sitio El trébol (San Carlos de Bariloche, prov. de Río Negro). Más sobre los niveles con fauna extinta. In A. Austral & M. Tamagnini (Eds.), *Problemáticas en la arqueología contemporánea* (Vol. 3, pp. 955–966). Río Cuarto: Universidad Nacional de Río Cuarto. Facultad de Ciencias Humanas. Facultad de Ciencias Exactas, Físico-Químicas y Naturales.
Hartley, R. (1992). *Rock art on the Northern Colorado Plateau: variability in content and context*. Hampshire UK: Aldershot.
Hill, J., & Evans, R. K. (1972). A model for classification and typology. In D. L. Clarke (Ed.), *Models in archaeology* (pp. 231–276). Londres: Methuen.
Humphries, C. J., & Parenti, L. R. (1986). *Cladistic biogeography. Interpreting patterns of plant and animal distributions. Oxford Monographs on Biogeography No. 12*. Oxford: Oxford University Press.
Layton, R. (1992). *Australian rock art: a new synthesis*. Cambridge: Cambridge University Press.
Loendorf, L. (2001). Rock Art recording. In D. Whitley (Ed.), *Handbook of rock art research* (pp. 55–79). Oxford: Altamira Press.
McDonald, J. (2008). *Dreamtime superhighway. Sydney Basin rock art and prehistoric information exchange, Terra Australis 27*. Canberra: ANU E-Press.
McDonald, J., & Veth, P. (2011). Information exchange among hunter gatherers of the Western desert of Australia. In R. Whallon, W. A. Lovis, & K. Hitchcock (Eds.), *Information and its role in hunter-gatherer bands* (pp. 235–247). Los Angeles: Cotsen Institute of Archaeology Press.
Menghin, O. F. A. (1957). Estilos de arte rupestre de Patagonia. *Acta Praehistorica I*, 57–87
Muzzolini, A. (2006). Classifying a set of rock art: how to choose the criteria. *Rock Art Research, 23*(2), 171–178.
Nelson, G., & Platnick, N. I. (1981). *Systematics and Biogeography: Cladistics and Vicariance*. Nueva York: Columbia University Press.
Onetto, M. (1986-1987). Nuevos resultados de las investigaciones de Campo Nassif 1. Valle de Piedra Parada. Provincia del Chubut. *Relaciones de la Sociedad Argentina de Antropología, 17*(1), 95–123.
Pedersen, A. (1978). Las pinturas rupestres del Parque Nacional Nahuel Huapi. *Anales de Parques Nacionales, XVI*, 7–43.
Pérez de Micou, C. (1979-1882). Sitio Piedra Parada 1 (PP1), departamento Languiñeo, provincia de Chubut (República Argentina). *Cuadernos del Instituto Nacional de Antropología y Pensamiento Latinoamericano, 9*, 97–111.
Pérez de Micou, C., Trivi de Mandri, M., & Burri, L. (2009). *Imágenes desde un alero. Investigaciones multidisciplinarias en Río Mayo, Chubut. Patagonia argentina*. Buenos Aires: Fundación de Historia Natural Félix de Azara.
Podestá, M., & Tropea, E. (2010). Expresiones del arte rupestre tardío en el ecotono bosque-estepa (Comarca Andina del Paralelo 42°). In F. Oliva, N. de Grandis, & J. Rodríguez (Eds.), *Arqueología argentina en los inicios de un nuevo siglo. Actas del XIV Congreso Nacional de Arqueología Argentina* (Vol. III, pp. 555–571). Rosario: Universidad Nacional de Rosario.
Podestá, M., Bellelli, C., Fernández, P. M., Scheinsohn, V., Carballido Calatayud, M., Forlano, A., Marchione, P., Tropea, E., Vasini, A., Alberti, J., Gallo, M., & Moscovici Vernieri, G. (2007). Primeros resultados arqueológicos en el valle del Río Epuyén (El Hoyo, Chubut). In F. Morello, M. Martinic, A. Prieto, & G. Bahamonde (Eds.), *Arqueología de Fuego-Patagonia. Levantando piedras, desenterrando huesos…y develando arcanos* (pp. 427–442). Punta Arenas: CEQUA.

Podestá, M., Albornoz, A.M., Vasini, A., & Tropea, E. (2009). El sitio Peumayén 2 en el contexto del arte rupestre del bosque andino patagónico. *Comechingonia virtual, 3*(2), 117–153. http://www.comechingonia.com. Accessed 06 June 2014.

Re, A., Belardi, J. B., & Goñi, R. (2009). Dinámica poblacional tardía en Patagonia meridional: su discusión y evaluación a través de la distribución de motivos rupestres. In M. Sepúlveda, L. Briones, & J. Chacama (Eds.), *Crónicas sobre la piedra. Arte rupestre de Las Américas* (pp. 293–309). Arica: Ediciones Universidad de Tarapacá.

Reyes, O. (2003). Evaluación de los sitios arqueológicos descubiertos en los sectores de Planicie y Semillero, curso superior valle de Lago Verde, cuenca hidrográfica del río Palena. *Región de Aisén*. http://www.piedraspatagonicas.cl. Accessed June 2010.

Richerson, P. J., & Boyd, R. (2005). *Not by genes alone: how culture transformed human evolution*. Chicago: University of Chicago Press.

Scheinsohn, V. (2003). Hunter-Gatherer archaeology in South America. *Annual Reviews of Anthropology, 32*, 339–361.

Scheinsohn, V. (2011). Rock art information among hunter-gatherers in Northwest Patagonia: an assessment of broad-scale and territorial models. In R. Whallon, W. A. Lovis, & K. Hitchcock (Eds.), *Information and its role in hunter-gatherer bands* (pp. 235–247). Los Angeles: Cotsen Institute of Archaeology Press.

Scheinsohn, V., & Caridi, I. (2015). Mind the network: cultural transmission, mutual information networks and rock art. In L. Mendoza Straffon (Ed.), *Cultural Phylogenetics: Concepts and Applications in Archaeology and Anthropology. Interdisciplinary Evolution Research Series*. New York: Springer (in press).

Scheinsohn, V. G., & Matteucci, S. D. (2013). A regional model of archaeological distributions for Northwestern Andean Patagonia (Argentina). In M. J. Figuerero Torres & A. D. Izeta (Eds.), *El uso de Sistemas de Información Geográfica (SIG) en arqueología sudamericana* (pp. 61–72). Oxford: BAR International Series 2497.

Scheinsohn, V., & Szumik, C. (2007). Distribuciones arqueológicas en la Patagonia norte: una perspectiva biogeográfica. In *Arqueología de Fuego-Patagonia. Levantando piedras, desenterrando huesos…y develando arcanos* (pp. 109–116). Punta Arenas: CEQUA.

Scheinsohn, V., Szumik, C., Leonardt, S., & Rizzo, F. (2009). Distribución espacial del arte rupestre en el bosque y la estepa del norte de Patagonia. Nuevos resultados. In *Arqueología de Patagonia: una mirada desde el último confín, tome 1* (pp. 541–558). Ushuaia: Utopías.

Scheinsohn, V., Szumik, C., Leonardt, S., & Rizzo, F. (2011a). La localidad de Río Pico (Chubut) en el marco de los patrones distribucionales del arte rupestre en el norte de Patagonia. In A. F. Zangrando, R. Barberena, A. Gil, & G. Neme (Eds.), *Libro de resúmenes de las VIII Jornadas de Arqueología de la Patagonia* (pp. 73–74). Malargüe: Museo de Historia Natural de San Rafael.

Scheinsohn, V., Leonardt, S., & Rizzo, F. (2011b). Investigaciones arqueológicas en el área centro-oeste de Chubut: más fuentes para la historia de la ocupación humana del territorio patagónico. In Actas del VIII Congreso de Historia Social y Política de la Patagonia Argentino-Chilena. *Las fuentes en la construcción de una historia patagónica* (pp. 279–283). Trevelin: Secretaría de Cultura de la Provincia de Chubut.

Scheinsohn, V., Szumik, C., Leonardt, S., & Rizzo, F. (2013). Classificatory criteria in rock art studies: making explicit the implicit. In Abstracts from International Rock Art Congress, IFRAO (pp. 169). Albuquerque: American Rock Art Research Association.

Schiffer, M. B. (1972). Archaeological context and systemic context. *American Antiquity, 37*(2), 156–165.

Silveira, M. (1988-89).Un sitio con arte rupestre: el Alero Lariviere (provincia de Neuquén). *Relaciones de la Sociedad Argentina de Antropología, 17*(2), 75–86.

Silveira, M. (1996). Alero Los Cipreses (Provincia del Neuquén, República Argentina). In J. Gómez Otero (Ed.), *Arqueología. Solo Patagonia* (pp. 107–118). Puerto Madryn: Centro Nacional Patagónico - Consejo Nacional de Investigaciones Científicas y Técnicas.

Silveira, M. (1999). El Alero Lariviere: un sitio en el bosque septentrional andino (Departamento Los Lagos, provincia de Neuquén, Argentina). In J. B. Belardi, P. Fernández, R. Goñi, G. Guráieb, & M. De Nigris (Eds.), *Soplando en el Viento. Actas de las III Jornadas de Arqueología de la Patagonia* (pp. 83–92). Neuquén: Instituto Nacional de Antropología y Pensamiento Latinoamericano. Universidad Nacional del Comahue, Facultad de Humanidades.

Silveira, M. J., & Fernández, M. B. (1991). El arte rupestre de la cuenca del Lago Traful (Provincia del Neuquén). In M. Podestá, M.I. Hernández Llosas & S.F. Renard de Coquet (Eds.), *El arte rupestre en la arqueología contemporánea* (pp. 101–112). Buenos Aires: SF.

Simpson, G. G. (1945). The principles of classification and a classification of mammals. *Bulletin of the American Museum of Natural History, 85*, 1–350.

Vignati, M. A. (1944). Antigüedades en la Región de los Lagos Nahuel Huapi y Traful 1–7. *Notas del Museo de La Plata, IX*(23), 24–29.

Whallon, R. (2006). Social networks and information: Non-"utilitarian" mobility among hunter–gatherers. *Journal of Anthropological Archaeology, 25*, 259–270.

White, A. (2013). An Abstract Model Showing That the spatial structure of social networks affects the outcomes of cultural transmission processes. *Journal of Artificial Societies and Social Simulation, 16*(3), 9. http://jasss.soc.surrey.ac.uk/16/3/9.html. Accessed December 10, 2014.

Whitley, D. S. (2001). Rock art and rock art research in a worldwide perspective: an introduction. In D. Whitley (Ed.), *Handbook of rock art research* (pp. 7–51). Oxford: Altamira Press.

Whitley, D. (2005). *Introduction to rock art research*. Arizona: Left Coast Press.

Whitley, D. (2011). Rock art, religion, and ritual. In T. Insoll (Ed.), *Oxford handbook of the archaeology of ritual and religion* (pp. 307–326). New York: Oxford University Press.

Whitley, D. (2014). Future directions in hunter-gatherer research: hunter–gatherer religion and ritual. In V. Cummings, P. Jordan, & M. Zvelebil (Eds.), *Oxford handbook of the archaeology and anthropology of hunter–gatherers* (pp. 1212–1242). Oxford: Oxford University Press.

Zhu, Q., & Keogh, E. (2010). Using CAPTCHAs to index cultural artifacts. *Advances in Intelligent Data Analysis, 9*, 245–257.