ANALYSIS OF PALAEOLITHIC BARBED POINTS FROM THE MEDITERRANEAN COAST OF THE IBERIAN PENINSULA: AN ETHNOARCHAEOLOGICAL APPROACH

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Abstract
The barbed points made of biotic hard tissues in ethnographic collections from Tierra del Fuego and from the Palaeolithic of the Mediterranean basin of the Iberian Peninsula are investigated. Following the guidelines in the work of Gerd-Christian Weniger (1995), we demonstrate that the criteria proposed in his original book are valid and that their application to the Palaeolithic record overcomes the purely descriptive stage of the previous studies. Our analysis shows that few of the analysed barbed points were true harpoons. The differences between the different barbed points may be due to a chronological bias, but are certainly due to functional requirements.

Keywords
Ethnoarchaeology, Tierra del Fuego, Palaeolithic Iberian Peninsula, barbed points

In the early eighties, Gerd-Christian Weniger visited us during our excavations at the Mesolithic sites of Vilanova de Sau (Barcelona) to learn more about our work on site. We understood his interest in the explanation of the hunter-gatherer societies of the Palaeolithic: Our respective theses (Estévez 1979; Vila 1981; Weniger 1982) focused on aspects of a palaeoeconomical interpretation of these societies in their palaeoenvironmental context. His thesis focused on southern Germany and ours on Catalonia. We had all focused on the functional analysis and on the use of ethnoarchaeology in a broad sense.

Our scientific trajectories ran parallel, without losing contact, and culminated in a ten year joint project on ‘The Prehistoric Settlement of the Mediona river valley (Alt Penedès, Catalunya)’ (Weniger & Estévez 1994).

INTRODUCTION

We will use the detailed work of Gerd-Christian Weniger (1995) on the barbed points of the end of the Palaeolithic in Western Europe as a reference. We would like to reevaluate his book eighteen years after its publication.

We will consider the barbed points of the Palaeolithic of the Mediterranean coast: Those from the north: La Bora Gran (Girona) were studied by us (Estévez 1979) and later by Rueda (1983); while those from the central and south coast were compiled more recently in two studies (Villaverde & Roman 2006; Roman & Villaverde 2011). These last two papers are essentially descriptive and not contextual. Their main goal continues to be the stratigraphic and chronocultural interest of the second half of the twentieth century. As in most studies of that time, the use or knowledge of the ethnographic information is superficial. They possibly followed the same approach as in Julien’s work (Julien 1982) and did not take Weniger’s 1995 and 2000 articles into account. Thus, the barbed points are considered simply as harpoons. They claimed that we cannot know their use and did not expand the functional discussion.

Prehistoric barbed points have been identified as harpoons since the second half of the nineteenth century. This identification has been maintained in the archaeological literature without much questioning or greater accuracy.

In contrast, ethnoarchaeological studies demonstrate that a functional approach is not only possible but there are very significant repetitions that manifest the existence of general laws of development for these hunter-fishers-gatherer societies.

In the study cited, Weniger studied ethnographic toothed points of North America to analyse and better understand the barbed points of the Magdalenian in Western Europe. In this analysis, he showed that the automatic identification of these points as harpoons was naive. In the ethnographic sample that he analysed, he found different
kinds of weapons and tipped hunting gear; not all of these functioned in the same way or fitted similarly into the classic definition of harpoons.

In fact in the very first detailed ethnographic descriptions, harpoons were strictly defined. In the classic review of the toothed tips of America, Mason wrote: “A harpoon is a piercing and retrieving device with movable head. The head is always set loosely on the end of a shaft, to which it is attached by means of a line. There are also hinge lance heads and detachable lance heads that could have also barbs. The tang is wedge-shaped, conical, or spindle shaped and in relation to the connecting line is roughened, notched, bulbous or pierced.” (Mason 1902, 197).

Based on the instruments of the northwest coast, Steward (1977, 65) defines: “The difference between the spear and harpoon lays in the manner of its use and the nature of the head of the weapon. The spear point was firmly fixed to the shaft, which was thrust at the prey and remained in fisherman’s hands.” The harpoon head became detached from the prong or foreshaft when it struck the fish. It was tethered to the shaft by the lanyard. Steward also distinguishes the throwing harpoon because it was propelled towards the fishes. There were specialised weapons and harpoons for diverse river or coastal conditions and for different prey: Spears for smaller fishes and harpoons for larger prey. A larger struggling prey could easily break the shaft or point if fixed and escape.

And the same distinction is repeated in other, more modern analysis (McMurdo 1973).

Finally, analysing the points in ethnographic museums morphometrically, Weniger intended to synthesize the characters most correlated with the different functions of these instruments. His ultimate goal was to achieve a functional interpretation for similar objects from European Magdalenian sites. Weniger showed that many Magdalenian barbed points can be perfectly compared with true harpoons or mobile harpoon-arrows from his ethnographic sample, though others may be better classified as non-mobile arrowheads or non-mobile spear points or leisters. Weniger concluded that certain features of the different functional types are easy to recognize: Beside some metrical characters and quantitative characteristics, all the harpoons or harpoon arrows need a basal device (sharp bulb or line hole) to work appropriately. Points that have no features indicating they could be attached to a line cannot be identified as harpoon points.

Despite this, some scholars still refuse to distinguish between different kinds of barbed weapons in the archaeological record.

Here we will follow Weniger’s framework and we will incorporate it into our own ethnoarchaeological analysis developed at the other end of the Americas (Estevez & Vila 2007). Our aim is to expand its contribution and to increase the predictability of the synthesis of the significant morpho-functional characters of these objects.

Although we will insist here on certain morphological characters, we know that for a relevant study of prehistoric tools (in this case of instruments for hunting and fishing) it is necessary to analyse the whole process of manufacturing and consumption. A proper study should analyse the sequence from the procurement of raw materials to the use and deposition of the used instrument. Concerning items made of animals’ hard tissues in order to hunt animals, it is also essential to have basic archaeozoological knowledge. Firstly, it is necessary to determine the raw material (the origin) and the waste and discard from manufacturing and use, much of which can go unnoticed among the archaeozoological remains as we have had the opportunity to observe repeatedly in our analysis of archaeozoological samples. Secondly it is necessary to propose plausible explanations for use based on the analysis of the potential prey as documented in the record and the potential of the palaeoenvironment.

Little is known about the process of development of such weapons at either end of the American Pacific Coast. A huge barbed point made out of a mammoth’s rib from the Pyramid lake in the lakes area of Nevada and dated to 10.34 ka BP shows that these instruments were already used in societies exploiting the lake’s resources (Meltzer 2009). Although there is no evidence of direct contact between the two geographical extremes, excavations at the oldest sites in the California islands (Erlandson et al. 2012) show that navigation here and the exploitation of Pacific coastal resources can
be traced back to 11 ka BP. As suggested by Erlandson (Erlandson et al. 2007), the kelp belt might have been a route of expansion for these communities. Although there is no archaeological evidence yet to demonstrate that continuity towards the south exists, where adaptations that preceded Holocene coastal sites, consisted of settlements around lagoons and exploitation of extinct megafauna (Standen et al. 2004; Jackson et al. 2004).

We now know that harpoons first appeared in East Africa prior to 90 ka BP. In this continent, their use continued until the Holocene, crossing geographical, temporal and technological borders (Yellen 1998). Perhaps harpoons accompanied anatomically modern humans in their expansion and thus reached America, Oceania and Australia (King 1825). As suggested by Mason, “the natives themselves are fond of wandering about, and they leave their ideas as well as their accoutrements” (Mason 1902, 236). The lack of linkages could just be a matter of sampling, taphonomic destruction or lack of research of coastal (submerged) sites, or non-preservation of these items, because they were made of perishable raw material.

Thanks to the work of Weniger, we also think that barbed points could have developed locally in Western Europe, between the Pleniglacial and the Holocene. The instruments are the social response to a need. This is why they were manufactured and used. But the individual/local responses created some variables that depended on each individual society, their technological levels (i.e. the development of the relations of production and of the productive forces) and some ideological variables (the capacity for abstraction, power of tradition, creativity, ability, etc.). There are also other requirements that mediate or restrict their design and construction. These are largely environmental, and include for example the mechanical laws involved in creating the object and the raw materials available to make these tools. Thus, the technique is consistent, in a way, with the physical laws of the raw material being processed (resistance to fracture, fracture shapes, size, firmness, hardness, etc.) and with the object to be obtained (size, shape, environment, resistance, yield level). But it is also and above all a consequence of the expertise, tools and traditions of the society that manufactured the item (Estevez 1979).

Obtaining aquatic animals and working in and with water also involves many conditions. The forms are repeated because: “the same animal will be killed in many places with similar harpoons because in the struggle for survival among weapons this or that form proved the fittest.” (Mason 1902, 219).

It is therefore possible that similar morpho-functional features were selected independently and developed in response to imperatives of use. It is plausible that they could have crystallized from previously existing technological features: Finned lithic arrowheads contain the idea of retaining tooth, bone spear-points document the mastery of the most suitable (for its penetrating power, resilience and the possibility of re-sharpening) raw materials. A hafting of these points that became loose might have easily brought to attention the advantage of releasing the tip shaft while these remained linked to each other. Such accidents are not uncommon, as have been demonstrated by experimentation (Stodiek 2000, Fig. 5.2, 74).

Ethnoarchaeology

We wanted to link ethnography and archaeology dialectically and seek to overcome the inability to study all the different expressions of the same social phenomenon together. Evaluation of methodologies used in prehistoric archaeology should enable the development of an appropriate archaeological methodology to approach prehistoric social formations in all their aspects. (Estevez et al. 1998; Vila & Estevez 2001).

Our ethnoarchaeological approach (Estevez & Vila 1995) required analysing and systematising all of the available ethnographic and historical information on the Yamana society of Tierra del Fuego of the nineteenth century. The aim was to achieve a complete ethnographic image, in order to be able to characterise that society. Therefore, the critical analysis of all available information (written ethnographic sources and images) had to include and integrate the study of the objects deposited in ethno-
graphic museums. Once we located these in Europe, where the most complete and best documented set of Fuegian objects can be found, the review of almost all these items was conducted in 1986 and 1987 (for a more extensive description of this work see: Estévez & Vila 2006). The materials were analysed from an archaeological analytical perspective (including the technical and morphological characteristics that reveal all the elements of the technical production process).

This gave us a new comparative perspective to permit us to examine materials from archaeological sites of the same age (we excavated six sites during our research projects developed in the Beagle Channel). We could also follow their historical development thanks to other archaeological research conducted in the area (Orquera & Piana 1999a, 2009; Legoupil 1994; Prieto 1999).

**Historical development of barbed points in Tierra del Fuego**

In Tierra del Fuego, barbed bone tools suddenly appear around 6.5 ka BP, without any documented previous local development (Prieto 1999; Orquera & Piana 1999a). They are slightly older than the first harpoons of the Northwest Coast studied by Weniger.

In the Northwest Coast, they date to after 6 ka BP, in period 2 of the site of Namu (after Carlson & Dalla Bona 1996). Further south in the Gulf of Georgia, although they were possibly some earlier toothed tips, harpoon points are certainly documented in the Saint Mungo phase (after 5 ka BP) of Glennrose Cannery or in the middle period in the south of the coast of Canada. Since that period, the development of the barbed bone points are well documented; these culminate in the classic form of multi-barbed fixed spear and mobile harpoon points. Towards 2.4 ka BP (the so-called Marpole period) harpoon points developed a cruciform base (Matson & Coupland 1995). Likewise, around 3.5 ka BP in the central zone of the northwest coast, double valve-composed harpoons, with or without independent tips (the true toggled harpoons) also appear.

In Tierra del Fuego, the first multi-barbed spear points and harpoons to appear (which have a cruciform base) are morphologically very similar to the equivalent tools of the Marpole period, thousands of years later. At the southern tip of South America, the exploitation strategies of coastal resources began at the same time as the barbed points. The first single-barbed weapons (harpoons) and the multi-barbed weapons (spears) were recovered in the lower levels of the sites of Tunnel I and Imiwaia in the Beagle Channel and in the Magellan continental area (Orquera & Piana 1999a, 2009; Orquera et al. 2011). The harpoons have a cruciform base and a truncated-cone proximal end (Fig. 1). They have one or two teeth (parallel or aligned) and some are decorated with incised lines. The same model persists until about the fourth century AD. After that (as documented in the top component of the site Lancha Packeawaia in the Beagle Channel), a new prototype appeared that continued until the time of European contact. The decoration disappears when this new form appears. The base has a shield (tongue) form. The harpoon has a single tooth that continues directly from the tip (Fig. 2 left).

Legoupil (1989) distinguishes four pre-European archaeological types, including the raw materials employed and the measurements in Seno Otway on the mainland coast of the Magellan Strait. One type is large, heavy and made of mandibular whalebone (which is the most suitable raw material due to its consistency). Another type, which is lighter but of similar size, has a harpoon point made of whale rib (a more porous and less resistant raw material). The difference between these two types may be due to the low availability of the optimal raw material, in this case the whale’s jaw, which provided a straight trunk and

![Fig. 1](image-url) Prehistoric harpoons of Tierra del Fuego. Decorated and undecorated harpoons, with cruciform base, multi-barbed points (after Piana & Orquera 2006).
a more compact, and therefore more resistant, tissue. Both of these types can be correlated with harpoons for hunting pinnipeds (sea lions and fur seals), as identified in archaeological sites, and with the use of canoes (Orquera & Piana 1999). A third type of harpoon is smaller, and is made of whale or pinniped rib. It could not be used in hunting large animals (as pinnipeds), because the teeth were too small (5 mm) and offered little resistance. Finally a fourth type of miniature harpoon (documented in Punta Baja site north of the Magellan Strait, as well in Tunel VII in the Beagle Channel), was made very expeditiously on pinniped rib (the most abundant raw material available) and had a very limited potential use (small animals).

Fixed multi barbed points were also found throughout the whole sequence. These did not change their form substantially.

The ethnographic barbed bone tools from Tierra del Fuego

Ethnographic information

The use of weapons with barbed points in Tierra del Fuego is well-documented in the ethnohistoric record. There have been depictions and descriptions of these artefacts since the first contact of Europeans with Fuegians in the seventeenth century (Orquera & Piana 1999b). This may be because these tools aroused the curiosity of Europeans, both because of the familiarity of European sailors and whalers with this type of instrument, and because of the frequency of its use by native men. Based on the description by a whaling captain, Weddell (1825, 165), two or more kinds of barbed tipped weapons were always mentioned. There are basically two classes of items described: Fixed-tipped spears and mobile harpoons (Fig. 2). This duality also existed in the Euro-American whale hunting. The two weapons were designed to fulfil different functions. The Fuegian harpoon was not designed to kill directly, but to fix and to mark the location of the prey, with the point fixed on the animal and attached to the shaft. The drag of the long shaft hindered the movement of the animal. Bleeding and weakened, the prey was easily reached; its position was indicated by the shaft. At this point it could be finished off with spear or a dagger.

The spear was used to penetrate deeply in the prey’s body in order to kill or finish off the animal. In the case of barbed spears, once impaled, its removal and the possibility of it becoming stuck again without causing a large tear, was difficult precisely because of its design. Therefore it is likely it was used to finish off the animal while it was being retained. The weapon could be recovered when the prey was butchered, if the point had not been broken as the animal thrashed about.

The Fuegian canoers used harpoons mainly for fishing and hunting seals and other mammals (dolphins and otters) in the water, and sometimes for collective whale hunting. Harpoons were also used for fishing. They used spears (leisters) with fixed barbed tips for fishing, hunting land animals (guanacos, huemul, otters …) and birds. The Selk’nam (Gusinde 1931) had a fish spear 110-140 cm long, with a single-barbed tip of 9-16 cm length. Its base was straight or slightly curved. They also used a spear to hunt sea lion. This had a non-mobile single-barbed point. The shaft had a minimum length of 180 cm; the length of the tip was 25 cm. Sea lions were finished off with a club.

Apart from these two weapons, the Fuegian canoers also used tridents for fishing. These were made

Fig. 2 Harpoon points (left) and spears (right) with the measurements taken. Spears: 1.- length; 2.- width and thickness of the tip; lengths: 3.- until the first tooth, 4.- barbed part, 5.- of the proximal base, 6.- of the distal base; 7.- maximal protruding of the teeth. Harpoons: 1.- total length, 2.- width at the height of the teeth, lengths: 3.- from the tip to the tooth, 5.- of the proximal base, 6.- distal base; 7.- protruding of the teeth.
entsirely of wood and had no barbed ends.

Arrowheads were triangularly stemmed and had fins and were made mainly of stone or, following contact with Europeans, of glass. There are some bone points of similar shape, but the use of barbed arrows is not documented. As active hunting weapons, they also used short-shafted daggers with tips similar to that of the arrows, but larger and thicker. And finally, slings were used for hunting birds.

Although there were some specific and special designs for different hunting targets, weapons were used opportunistically on each occasion, as they were available. We have, for example, archaeological evidence of hunting sea lion both with harpoons and arrows (Mameli et al. 2005).

This whole panoply of hunting instruments is shared by different ethnic groups recognised by ethnographers as Yamana/Yaghan of the southeast, Alakaluf canoers of the north west coast and the Selk’nam terrestrial groups of the centre and north of Isla Grande, although differences can be recognized in the morphology of those tools between the different zones in the archipelago of Tierra del Fuego and the neighbouring mainland.

We have studied a sample of such weapons in the ethnographic collections of museums (Estevez & Vila 2006a). We did analyse single or two-toothed harpoons that come from the two major ethnic canoeing groups, Yamana and Alakaluf.

We were also able to determine the existence of multi-barbed points, attached to a lateral groove at the end of a large wooden shaft. These spears also came from the two groups of canoers. We also analysed tips with a single tooth, similar to those of mobile harpoon points, but made from guanaco bones and not fitted to be mobile. These came from the regions of the terrestrial northern groups.

We completed our study by analysing small barbed points that accompanied models or toy canoes.

**SPEAR POINTS**

According to ethnographic descriptions, we identified some differences between the most common types in the northwest, the southern and the northern terrestrial group (Fig. 3). However, there is no unanimity among ethnographers about the presence of different types of spears within each of the different areas. It is likely that this is because there was no morphometric discontinuity between these weapon types, but rather a great flexibility in their use. According to Gusinde (1937), the most important ethnographer of the Yamana group, there were various types: One with a 3 m long shaft, whose point could be single-, bi- or multi-bearded; a lighter spear with shorter shafts intended for hunting birds; and a third even lighter, with one or two notches to accommodate one or two multi-barbed points to be used for fishing.

According to Empereire (1963) the northwest people had different fixed barbed points: One with two teeth for fishing and hunting otters and one with...
two rows of barbs for hunting huemul (a south Andean deer).

The tip of the spears was inserted into the shaft on a lateral groove and tied very strongly with a leather strap or twisted whale tendons (Fig. 4).

Multi-barbed points were obtained preferably from whale jaws. Cetacean ribs were used to make points for small spears (for birds and fish). Seal ribs were also used, although the resulting point was too small for a wide use, and sometimes hardwood was used for points used to catch fish.

In the sample analysed in the museums, we included some spears, which were not functional (toys or models) in order to statistically determine the lower metric limit for this implement. To characterise possible differential patterns of production, we took the measurements shown in figure 2.

Morphometric analysis results show that the measured shafts vary from 179 to 310 cm in length and 1.3 to 3.4 cm in diameter. The toys or models do not exceed 60 cm. Shafts marked “Alakaluf” are shorter and those from Orange Bay (Yamana) in the south, are the longest. The shaft section can be either round, square or octagonal, there is no correlation between this and length. The proximal tip is pointed. The grooves to hold the point vary from 6.2 to 10.6 cm long. Almost half of the shafts are red coloured.

There is no correlation between the length of the shaft and that of the point.

The tips were made of whalebone, but five were made of wood. These do not differ morphologically or metrically from the others.

The base of the points is little worked: The proximal end is just chipped and sawed, truncated or, rarely, rounded by grinding.

It is possible to morphologically distinguish two models: One with the tip and the basal portion clearly distinguished from the medial section and containing teeth,

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**Fig. 4** Shafting of ethnographic Fuegian harpoons and spears: left side: a large harpoon in the middle small harpoon. At right: two spears.
and one with a less marked discontinuity between the medial and distal portions. The first also has no notches in the base, while the second may have on average between 6 and 7 lateral notches (Fig. 3).

The first may coincide, in most cases, with a sure assignation of “Alakaluf” (LA), while the second is predominant among those ascribed to “Yamana” (LY). But there are clear outliers. There are also examples that are attributed to a group and are like those of the other (LA? or LY?). There are also designs that mix metric or morphological characters of both basic models, and some with characteristics that are completely beyond the two dominant models.

We can explore this characterisation by quantitative and metric analysis. With respect to the total length, two groups can be perceived: One longer than 21 cm in length (maximum: 61 cm, mean: 36.8 cm) and another below 15 cm. Of the latter group, a 15 cm specimen collected by the Mission Scientifique du Cap Horn (1882-1883) is recorded as toy. All multi-barbed points accompanying miniature canoes are included in this latter group. Some are clearly separated from the rest because they are longer than 50 cm (see Fig. 5).

The width of the points is highly concentrated around 2.1 cm. There is also a skewed distribution toward lower length values from the apex to the first tooth. All of the items with values greater than 15 cm belong to the type without lateral notches in the base. The protrusion of the most prominent tooth lies between 0.7 cm to 0.8 cm or 1 cm to 1.3 cm.

The only measurements that correlated throughout the whole sample are total length and the length of the toothed portion and the last with the number of teeth (Fig. 6). For non-notched points, the total length correlates with the length from the apex to the first tooth, but the total length does not correlate with the number of teeth. For points with notches, the number of them and the length of the toothed portion are correlated with the total length.

The length of the zone with teeth and the length from the apex to the first tooth are the two variables that best differentiate the two groups for most of these objects (Fig. 7). Likewise, the indices obtained by dividing the length of the teeth by the total length and dividing the length to the first tooth by the length of the proximal part (the base) are different. Points with notches have values greater than 60 for the first index while the values for the other type are less than 40 with only few exceptions. Notched points have values below 30 for the second index while the other type has indexes above 40 with just two exceptions. The histogram drawn for the number of teeth (Fig. 8) shows a distribution with three peaks (8-10, 13-15 and 18-20).

In short, two morphological models can be distinguished morphometrically. Within them and by size, we can sepa-
rate true spears from toys or models. Although there is a standard size for the points, there are some very large examples. The points with two rows of teeth (which some authors attribute to hunting land animals) are morphometrically indistinguishable from the general models.

**HARPOONS**

There is no consensus on ethno-graphic descriptions about the harpoons. Most authors speak of a single type. Gusinde however points to the existence of two types: One large and one small among the Yamana and also between a short harpoon and a long one with one or two teeth among the Alakaluf.

The small harpoon was similar to the large one, but with a shorter shaft and without the long strap. Harpoon points could be changed rapidly accordingly to the prey size that was to be harpooned. When hunting seals they used a single -barbed middle sized or a short bi-barbed point of approximately 15 cm. For cetaceans, the bone point used would measure over 40 cm.

The ethnographic collections contain asymmetric single-barbed harpoons and lanceolate harpoon points with two symmetrical teeth (Fig. 9). According to some authors, this second form was more frequent in the West. However there are no such two-toothed points in pre-European archaeological collections. It is possible therefore that this new form was the result of an imitation of European harpoons that were used since the fifteenth century (Merino 1986), rather than an indigenous development. Interestingly in the descriptions of the use of modern harpoons, single toothed irons were considered better than those with two teeth, because the last could be more easily detached from the whale (Lytle 2008). The evolution of European harpoons responds to experience, which shows that iron harpoons with two teeth are actually counterproductive for attaching to prey. A better design is to simplify the point to a single flue, increase the protruding of the tooth and thicken the stem to provide greater resistance to fracture. Finally the European whalers replaced the older harpoons with female points, points with basal fins and lastly with a toggled point (similar to toggling harpoons like those of the native people of North America).

We analysed 14 complete harpoons: 8 classified as Yamana (AY) and 2 as Alakaluf (AA).

All points marked as Yamana have a single tooth and can be distinguished from harpoon points marked as Alakaluf because the latter have two teeth.

The information they provided is complemented by 8 shafts and 150 loose harpoon points and with small or training harpoon models that were used by children as toys.

The two morphologies (single-barbed points or two-barbed) are not
assigned strictly to one of three ethnic groups of Fuegians. Although in some cases there could be some doubt about the accuracy of the ethnic assignment of the collections in the museums, there are enough examples that are securely identified geographically and presumably ethnically.

We have therefore chosen to morphometrically contrast the ethnic ascription (explicit or by the geographical reference) of the museum information.

We assume that there was a crossover between characteristic features of the different Fueguian models. In this case, the morphometric analysis would help us to detect a particular feature that would isolate different items within each of the two normal formal types. This means that copies of harpoons of a group made by other people may not fully comply with the standards of the originals.

Alternatively, it could be the case that we could identify different trends in manufacturing but that these trends did not respond to a normative ethnic model but rather to a functional need. The bi-barbed harpoons could have had a use different to that of the single-barbed harpoon, regardless of their ethnic origin. In this case, we would expect a significant morphometric difference between the two types. We should also assume, in this case, that there was some sort of function/use that was more frequent in one area than in the other.

Finally we might think that there was a flow and permeability between the people in each group and their respective items. This would mean that there was no rigidity when manufacturing one kind or another and that there was permeability of people and/or of property. This would result in a series of clines or trends that would be likely to typologically group the geographically closest harpoons.

Fig. 9 Variety of harpoon heads. Top: AY (third from right: guanaco bone, second from right: toy PTY). Top extreme right: Selknam; Bottom: AA.
For the statistical analysis, we used the morphometric measurements shown in Figure 2.

We have added the small harpoons to verify that there really is a significant break between the effective hunting harpoons and those that could serve as a toy for entertainment, training or exchange.

As in the case of the spear points, with the harpoons there is no correlation between the length of the shaft and that of the point. There is also no correlation between the length and diameter of the shafts (Fig. 10). The models or toys (less than 100 cm long) are clearly separated from the actual hunting harpoons (length over 160 cm). The smallest in the scattergram of length/diameter of the shafts is attributed to the “Selk’nam”. However, even its length falls within the variability of the “Yamana” shafts. It also has a terminal transversal notching slot like the other harpoons and no longitudinal groove as the fixed spear points. In fact, it is a real harpoon.

With regards to shaft length, we see three groupings (Fig. 10): One group contains shafts of less than 180 cm, one around 260 cm (not normalized), and another of 320 cm. If we ignore the diameters below 2.5 cm (corresponding to models or toys), we observe two groups: one with diameters up to 3 cm and the other with more than 4 cm. This may be interpreted as coincident with the discrimination made by Gusinde between small and large harpoons, based on the size of the shaft. The size of the shaft is not, however, correlated with the length of the point.

**Raw Material**

Wooden points are proportionally less frequent for harpoons than among spears. That may mean that low quality raw material was considered even less satisfactory for making harpoons than for obtaining spear points. Indeed, bone is always tougher than the timber even when this is as strong as *Maytenus magellanica*.

There are four bone points made of guanaco diaphysis, a raw material of lower quality than whalebone. The fact that in the absence of whalebone, guanaco bone was preferred to wood for harpoons is contrary to what happens for spear points. This can be easily explained: It is more difficult to carve multiple teeth in mammalian bone than in wood, and bone does not permit the larger sizes required for spear points.

Among the guanaco bone points, two single-barbed examples are designated as “Selk’nam” (PAO). Another is marked “Yamana”, yet there are no significant differences between them. They are all small. One falls within the length range for miniature pieces (PTY), but is separated from this category because its base is proportionally wider in relation to the width of the tooth. All these three points have the most elongated base of the whole sample. Those with the most elongated base came from the terrestrial northern group and some of them have no retrieving device. Thus they coincide with the description of Gusinde (1931, 226) of the small spears used by Selk´nam women. According to him, these would therefore be small spears for coastal fishing.
There is no good correlation between the metric variables chosen. The only correlated measurements are the total length and the length of the point. A graph with these two dimensions (Fig. 11) helps us to visualize the differences between the two morphological models. The two-barbed points (PAA) have the length of the point proportionally longer than the single-barbed points (PAY). The single-barbed points made of guanaco-bone (PAO) are small, although they are somewhat larger than the models (PTY). Those made of wood; however, lie in the upper part of the variability in total length and point length.

The graph also shows that the variability of the two-barbed points is lower than that of the other points. All of the two-barbed points have a total length of less than 35 cm and a point length up to 25 cm. Only two are beyond these limits: One in relation to its total length (36 cm) and the other in relation to the point length (31 cm).

There is no marked distinction between points suitable for hunting and the miniature points.

The single-barbed points (PAY) are on average longer than the two-barbed points (PAA), and they have a longer point and a larger proximal base length. There is no normal distribution in the measurements of the single-barbed points. The length of the base, the width ratios and the proportions of the base do not have a normal distribution. It follows that the whole dimension of the point is the dominant variable. There are unusually large examples, 14 of which have a length greater than 40 cm (Fig. 11 oval) and can be attributed, according to ethnographic descriptions, to whale hunting.

The two-barbed points are quite homogeneous. Only two stand out for lengths greater than 30 cm, one also has a very short base (<2.4 cm). Two points are proportionately very long; three have very narrow proximal bases (index of base width/base length <1). A wooden two-barbed point is characterised by an elongated base and a very short tip.

The single-barbed harpoons have a base proportionately and in absolute dimensions greater than those bi-barbed. However the observed differences between them are not large enough to assume a different use.

Regarding the correlation between attributed ethnicity and morphometry, the evidence is more consistent with the hypothesis of a cross-over of models than simply with the direct flow of materials or people, although this may be the result of adoption of a new model of European style by the north-western population. This is considered likely as there is no significant difference between the general morphology of the single-barbed points (the only ones found in the original archaeological native record) attributed to the southeastern canoers (Yamana) and those two-barbed examples that are predominantly assigned to the northwestern canoers (Alakaluf).

However, in the ethnographic record there are items with mixed features: One of the single-barbed points is marked “Alakaluf”. It has indeed incisions in the base like some proper northern two-barbed points. Conversely bi-barbed harpoons some of which are attributed to “Yamana” present special secondary characteristics within the homogeneity of this type. One example is on wood and is stained red (a characteristic that is more common among single-barbed) and its base is very narrow. Another example has prominent asymmetric teeth, and another is very large; two others have proportionately short points that are formed by an elongated base and a very short tip.
and are single-barbed. Finally in one case there is an incision on the teeth that is not found in any other case.

**Fueguian spears and harpoons general discussion**

Through the analysis of ethnographic barbed points, we were able to draw conclusions that could be useful in tackling the archaeological study of similar instruments.

First regarding the distinction between mobile and fixed points:

Harpoon points always have a retrieving device in the base. Spear points may or may not have this. But harpoons are clearly distinguishable from spears because the proximal part of the base is clearly separated from the distal part, while this distinction is not as marked on the spears. However they cannot be distinguished based on the ratio base length/total length. The notches of the LY in some cases could lead to confusion because they could be considered as the distal part of the base. As already remarked by Weniger, we also conclude that the presence of a retaining element is not a sufficient basis to identify a piece as a harpoon. However, all harpoons have a clearly highlighted retrieving feature in the base.

Spears have a smaller relative width, but larger pieces have quite similar proportions (Fig. 12). The average width of LY distinguishes them from LA, but there are LA outliers that clearly differ from the norm. Toy spears are smaller than the functional ones. Toy harpoons fall into the lower limit of the functional weapons. Small and medium two-barbed harpoons are wider than the single-barbed (as Weniger also describes), but large examples have similar proportions.

In conclusion, there are also morphological and metric features of the southern-most barbed points that permit (as with that observed in North America) a distinction to be made between the fixed and the detachable points.

Both harpoons and spears, as well as their constituent parts, had many variations in Tierra del Fuego. Two precautions must be retained in this regard: Although different types of points could have somewhat preferential use or prey, there was also some flexibility and interchangeability of types.

The single-barbed points show greater variability, especially because there are unusually large examples of this form. The large shafts essential for these very large points could also be used with smaller points (the medium standard size), however. The most significant feature when the animal received the impact and in order for it to remain inserted in the prey, was represented by the shaft. The ethnographers perceived subtypes that are not always recognisable morphometrically. That means that morphometric variability must be considered significant only to a certain extent for establishing subtypes.

The vast majority of ethnographic observations were collected after 1880. Therefore it cannot be excluded that some of the types, for example, the symmetric double-tooth form (AA), could be a native copy of the double flue irons observed in whaling ships. It could also be as a consequence of the ease of cutting provided by the European metal knives, which allowed increasing the sizes and of the number of teeth. There have been, until now, no items in the archaeological record as large as big ethnographic harpoons. The presence of those very large harpoons can only be explained by their use against cetaceans.

We have to consider the speed of the change that occurs when introducing new technological elements. However, not all changes are economically rational, nor have the power to increase the effectiveness of the instruments. This is the case of the adoption through imitation, of the European type two-barbed points.

This analysis shows a trend towards greater representation of the single-barbed in the southeastern area, but this range was permeable to penetration by two-toothed symmetrical types. The relationship between the two types of form and the ethnic groups established by ethnographers is ambiguous. There are always outliers, mixing the original normalised features with those of other models, as well as rare examples with unique features.
It is not always easy to discriminate (even in a well documented ethnographic case like ours) as to whether the difference between one type and another is due to different uses, or whether there are loan forms or characteristics from one area to another.

**Ethnoarchaeological Analysis**

Confronting ethnographic data and archaeological records are key issues for interpreting archaeological evidence. The data offered are complementary: The first type of data relates to a biased sample of all products. In fact however, they consist of only the ethnographic objects that interested the collector. That means objects that are generally in good condition, finished and ready to use. In contrast, most objects found in archaeological sites are generally rejected, consumed or discarded or not used. These objects have normally suffered some changes during deposition, burial and even during the process of recovery.

It is therefore very interesting to see how the archaeological and ethnographic records differ. A comparison between these can help us to gain a better understanding of the extent to which the former is representative and constitutes a valid sample of the original products. We can thus check to what extent we are skewing our interpretation of the prehistoric processes of production and consumption and their historical context, in which we are interested.

We found numerous remains related to barbed points in two of the sites that we excavated in the Beagle Channel. In Tunel VII site (Piana & Estévez 1996; Estévez & Vila 2006b) and Lanashuaia, the material represents all phases of production and consumption of these instruments, in fact only very few harpoons would still be functional. There are a lot of original whalebone segments and pinniped ribs whose production

![Fig. 13  Fragments of barbed bone ends: A) Lanashuaia site and Tunel VII: B) harpoon and reused fragments, C) distal spear, D) miniature harpoons; E) rejected and not finished toy harpoon; F) mesial, basal and G) apex fragments of harpoons H) harpoon fragments with remaining tooth.](image)
has been interrupted. There is also extensive manufacturing waste, debris and chips together with stone tools that were used for working bone (Clemente 1997). Other fragments are the result of amortisation by use: For example, broken points or apex fragments; some are tip fragments that retained a tooth (the fracture was oblique). There are also fragments left from the proximal base and from the distal base (broken on the narrowest part) (Fig. 13). Some harpoons, whose tip was broken obliquely and which have lost the tooth, have been reformatted as can be identified through polishing on the distal broken extreme and have been reused as awls or spatulas.

Two specimens (one that could be entirely functional and another that was broken before it was finished) are so small that they can be compared with the toys and ethnographic models.

There is only one multi-barbed point (broken above the half).

We found the proximal end of a whale jaw (the meat was consumed and the remains deposited on the site) near the site of Lanashuaia. This bone had been cut peripherally to obtain the raw material base for the preparation of barbed points.

The majority of the items in the sample (except two whole still-functional harpoons and a toy) correspond to by-products, rejects or scraps of use, including recycled tools.

This skewed representation regarding the ethnographic evidence is not a special case: In the Otway sites on the mainland (Legoupil 1986), dating from the seventeenth and eighteenth century, there are harpoons and spear points. But there are only 8 whole and 33 fragmented harpoons (out of a MNI of 23 harpoons).

In short, the remains of barbed points found in archaeological sites are mostly broken pieces discarded after the point or the shaft was broken or when an oblique fracture of flexion occurred. The shaft is the weak point of this instrument. It breaks when bent, leaving an oblique fracture and the distal fragment with the point still united to the tooth. Yet the fact that we recovered the distal tips of some harpoons suggests that even after breaking the instrument, the prey was recovered anyway.

The miniature harpoons (probably for child training) were discarded still in use or some even before they were finished.

Fig. 14  Map of citated sites with harpoons in the western Mediterranean basin.
The only spear point is broken in the middle. Given that the canoe was always provided with at least one harpoon and one spear, we must assume that they were not amortized as quickly as the harpoons. Their manufacture required more extensive time investment and their use should involve less stress or risk of breakage.

**Review of prehistoric barbed points of the Iberian Mediterranean coast**

**Analysis**

The morphological and technical sophistication of the Paleo-Mesolithic barbed points caught the attention of European prehistoric archaeologists. Since Breuil (1912) they have been taken as fossil leads for the Late Glacial techno-complexes. Scholars have also repeatedly tried to formalise descriptive sheets on the peninsula (Ortega 1984) and their chronological and geographical variations, the process of manufacture and decoration of these pieces, as well as the roles they played in recent phases of the Cantabrian Magdalenian (González Sainz 1989). The experimental replicas made by various authors (e.g., Rueda 1983) were used to verify the feasibility and technical difficulties involved in their manufacture.

However, until the 1980s there was only one known site in Catalonia that had produced this type of instrument (apart from the slightly indented items of Parpalló). Later, other pieces were found, which expanded the distribution area to the South of the Mediterranean, from Matutano cave to sites in Malaga (Fig. 14).

We have seen that the fundamental criteria for discrimination between mobile and fixed points, or rather the rule that permits a piece to be identified as a non-harpoon is the absence of retainer in the base. Secondly we can discriminate between arrows and other weapons by the size, proportions and the number of teeth (Weniger 1995, 2000).

In Catalonia, there are data on 14 barbed pieces, made on antler. They come from two collections (Alsius and Bosoms) from the site Bora Gran (Canal et al. 1990). On six pieces, the base was carved with burin in an onion like form, which produced a thickening. Six others simply have a blunt or straight, bifacially scraped or polished base. Some pieces have a superficial decoration made with a very fine point. The only almost complete example from Bosom’s collection could function as a fixed point, because the type of base had no marked retrieving feature. Two points have a rounded base and a single row of teeth. The two most complete items, match the features of R1 Group; Weniger’s big barb and close barb types. Therefore they can be interpreted as fixed points.

The two most complete examples, with retaining features at the base, have two rows of teeth (Fig. 15). They have different sizes and follow the same model as others form across the Pyrenees (Grotte de L’Oeill (Aude), Sachi 1986, Fig. 158,1), La Crouzade 5 (idem. Fig. 142,1) or Grande Grotte de Bize (idem. Fig. 135,2) and Caune Belvis (idem. Fig. 164,1). One type correlates with the R2 closebarb and another, small one to the multibarb type R2, They correspond therefore better functionally as a small harpoon and as a harpoon-arrow respectively.

There is just one example that could be discarded while still usable (even though its point is quite blunt). There are five basal fragments (two of them include the sign of a broken tooth). There is a medial fragment with broken teeth, three retain the point and some fractured teeth, and 5 are probably manufacturing rejects with fractured teeth.
extremes and with unfinished or broken teeth. Finally there are 6 more that could be discarded fragments of points with unfinished teeth.

In the central and southern Mediterranean coast of the Peninsula, there are 45 points fragments that have been compiled and illustrated (Villaverde & Roman 2006, Fig. 3; Roman & Villaverde 2011, Fig. 2). They come from Matutano, Blaus, Foradada, Volcan del Faro, Parpallo, Tossal de la Roca, Cendres, Mejillones, Nerja, Higuéron, Hoyo de la Mina and Victoria (Fig. 15).

From the figures (Villaverde & Roman 2006; Roman & Vilaverde 2011; Martínez Andreu 1999; Ollaria et al. 1999; Casabó 1995), we can see that most of the points were no longer functional and also that none is complete, except an example from Cendres 9, which is complete but broken into three pieces. There are two (Cendres 13 and Tossal) with a broken apex, although it could have been re-sharpened. Some have the point broken beyond repair (Cendres 3 and 7). Both from Victoria and two from Cendres (11 and 17) have some broken teeth. Finally two more, one from Matutano and Cendres 18, have a broken or unfinished base. All other elements are waste fragments, the result of use: Eleven medial, three medial-distal with a broken apex, six point fragments and two basal fragments (Cendres 19 and Higuéron 5).

All points have a single row of teeth. None of the bases has a morphology that allows them to be detachable points. Therefore we can say that none of those that conserve this part can be recognized as a true harpoon. Most of them are fixed points; they could be leisters, arrows or spear points. The general model with the teeth integrated into the overall lozenge form closely resembles the African harpoon model described by Yellen (1998, Fig. 2,5-7), but the significant difference is the small proportion of the proximal base and the presence of notches or incisions around the perimeter that could act as a retainer in the African harpoon points.

The point of Tossal is similar to the Bora Gran R1 point and follows the general model with more prominent teeth than the others from Valencia and Andalusia.

Nerja (8 and 6), Cendres (1) and one of Foradada (12) may reflect an arrow model (they are thin and parallel sides) but they are medial or distal fragments without definitive discriminatory features. Therefore there is no guarantee at present whether they
represent a single functional model.

Thus, as observed in ethnoarchaeological sites, most of the remains are waste and discard or failures during manufacturing. Before a typological analysis, and a possible reconstruction of the original form can be done, it should be determined which items could be unfinished manufacturing waste or those that could have been re-sharpened or reformatted. Some of the pieces that have been considered harpoons are unlikely to be true harpoons or even barbed points (e.g., those of Parpallo and Matutano 15 and Matutano 16).

In the current state of knowledge we cannot exclude that the differences observed between the barbed points was due to a different chronology.

It is possible that most of the examples from Cendres date to prior to 13 ka BP (Roman & Villaverde 2011 Fig. 2) and those from Nerja, which are different, after 12.5 ka BP. In the Catalan site, we cannot refine the chronology and discriminate the palimpsest, because it was excavated long ago. Therefore, at present, the sample does not permit assessment of whether the differences are chronological.

Thus if we would take the barbed points as a social demarcation criterion (as cultural type, like Mediterranean Magdalenian), at least the analytical comparisons should be established only on the same type of instrument (e.g., fixed points R1) since the differences between points R1 and R2 might respond either to a functional or chronological bias.

![Fig. 17 Comparison of ethnographic barbed tips of Tierra del Fuego (TDF) and collected by Weniger (NA=north America, R1- one row teeths, R2- bilateral teeths): dotted lines harpoons, pointed lines= arrows, HA= harpoon-arrows, MPA-multipronged arrows, little black dots= Mediterranean points, blank circle= from petite de Bize, triangle=Azilian arpon from Petite de Bize. The groups of harpoons, spear points and fixed points are clearly separated (the circle diameter corresponds to the standard deviation). The Mediterranean points cluster around the smaller instruments and do not have the characteristics to be used as harpoons or spears to hunt seals. They are located close to the fixed points of spear or arrow. The longest point that stands out from Cendres (C9) is close to the multipronged arrowheads. The only example that we have classified as a harpoon (BG128) approaches Weniger’s small harpoons. Characterized as the only harpoon (AZ) is the Azilian of the petite Bize. It matches perfectly with the dispersion of the ethnographic seals harpoons.](image-url)
**Morphofunctional Explanation**

Ethnographic analogy and ethnoarchaeology are good ways to generate founded hypotheses and conceptual tools to guide the methodology that facilitates the interpretation of Palaeolithic evidence.

We have seen in the ethnographic literature that the barbed points were used for hunting terrestrial and aquatic mammals, birds, and for fishing. The harpoons in particular were best employed in fishing and hunting of animals in the water. The mass of the weapon is the key variable and must be adapted to the particular mode of propulsion and the distance it must travel to reach the target. The size of the points although secondary, in this case, must be roughly adjusted to the size and anatomy of the prey (Fig. 16).

During the Upper Palaeolithic, aquatic resources were available along the Mediterranean coast. At first they could easily be appropriated opportunistically from the coast (especially if stranded or during the breeding season).

In the Cantabrian of the peninsula, as well as abundant archaeoictiological evidence of salmon fishing there are designs in rock and mobile art in Altamira, Ekain and El Pinal (Merino 1986). There is also evidence of consumption of *Phoca vitulina* (Altamira and Tito Bustillo), *Halichoerus grypus* (La Riera and Las Caldas) and *Monachus monachus* (La Forja), last at least in the early Holocene. There are also some Palaeolithic pictures (Peña de Candamo that may be interpreted also as phocids (Serangeli & Dalmau 2001). Apart from the phocids, there is evidence at least of scavenging of cetaceans and delphinidae (Corchón 2008) and even a possible representation of a sperm whale in Tito Bustillo.

In contrast, in the Mediterranean coast of the Peninsula, the exploitation of coastal resources is less documented. There is evidence of the consumption of *Monachus monachus*, for example, during the Middle Palaeolithic at Gibraltar and at Cueva de Nerja in the late Upper Palaeolithic (Marin et al. 2011). There are indeed representations of fish in the rock art in Pileta, El Higueron (Maura 1995) but also more inland in Ardales (Ramos 1995). Nerja silhouettes have been interpreted as fish or seals. Barbed points have also been recovered in two of these sites.

Some of these aquatic resources that could be obtained with barbed points were also available inland: There are remains of trout and Atlantic salmon in Serinyà, for example. Although phocids could penetrate some rivers, as documented in the Atlantic (Erlendson 2001; Corchón et al. 2008) this behaviour is not documented for the Mediterranean monk seal, *Monachus monachus*, now restricted to highly protected coastal areas.

Most exemplars come from sites that are near the coast today. The interior settlements that provided this type of instrument also yielded remains of fish (Matutano and Bora Gran) and are near old lagoons and/or rivers. Others like Cendres (today overhanging the sea) were around 15 km far from the ancient coastline, but close to coastal lagoons (Fumanal & Badal 2009). There is also strong evidence of movement between the coast and inland and transport of coastal objects to sites over 60 km inland as Parpalló, Ambrosio, Cova Matutano and the Serinyà area.

We can therefore link the use of barbed points with the acquisition of aquatic resources.

Although most of the single-barbed points (which are perhaps the oldest) cannot be regarded as true harpoons, they could be used as leisters for fishing. The points with two rows of teeth (in the absence of direct dating we might tentatively hypothesize to be more recent) could be used as small harpoons or harpoon-arrows.

In this case we should ask what would be the type of prey that would be target. Compared with the ethnographic data and, considering the species present in the zooarchaeological record, the answer is that it must be fish, because the points do not have the necessary size to be used in the hunting of the documented aquatic mammals. It is not until more recent levels (identified as Azilian as in the petite Grotte de Bize) that harpoons with size and morphology suitable for this type of hunting (Fig. 17) can be found.
CONCLUSIONS

The study of archaeological materials from prehistoric hunter-gatherer societies cannot be fully addressed, at least for now, because there is still an insufficient body of middle-range theories or conceptual tools to achieve a satisfying interpretation.

A purely descriptive study of the type, which takes place too often, is inefficient. In the end, it only achieves the sequentially ordered sorting of recovered materials through analysing stratigraphic contexts and absolute dating. The functional categories that have been routinely used, following a decades-old tradition, are based on proven insufficient ethnographic information. The internal studies served to show the fallacies of the traditional chrono-cultural empirical orderings (e.g., González Sainz 1989; Jullien 1982). Although if indeed morphometric correlations are shown to exist, they could not answer the question of the reasons behind these correlations.

A study like the one proposed by Weniger (1995) shows that it is possible to overcome this initial descriptive and classificatory stage. Progress is possible by recognizing patterns in the technical development of instruments (in this case weapons used to obtain animal food), thus unravelling their function (i.e. the cause of their production).

Based on the recurrences and especially on the analysis of the contextual relationships we can construct long-range explanations even starting from a record as basic as the barbed bone points. The previous development of bifacial lithic projectile points (arrows or propelled javelins) before the development of barbed bone points, the disappearance of the decorations and the debugging and simplification of forms are recurring phenomena in different parts of the world. The repeated and independent development of barbed points and especially the harpoons in distant times and places, and the comparison of their forms with respect to their use permits a synthesis of the more meaningful functional characteristics, and can identify the more conjunctural and random features. The same conclusions can be used as a starting hypothesis for other case studies.

This requires a focus on the whole set of social subsistence strategies, exploitation of the environment, relational analysis, i.e., in this case palaeocoast lines, river flow regimes, the location of the lagoon areas, the archaeozoological evidence, the processes and instruments of production, its context of use (use-wear is essential) and the distribution and discarding of products. This is an old claim (Vila & Estevez 1989), but unfortunately still topical because in general we are far from approaching or even beginning to pursue these objectives.

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PLEISTOCENE FORAGERS ON THE IBERIAN PENINSULA
L. point

L. shaft