Textile Techniques and Technology in the Andes

PREVIOUS PAGE
Fig. 1 A girl weaving on a rudimentary loom.

THE structures and techniques of Andean textiles, whether in archaeological, historical (colonial and republican) or contemporary ethnographic examples, are considered some of the most complex in the world. Although the tapestry and other weft-faced weaves from this region are perhaps the best known, without doubt it is in the warp-faced patterned examples where these structures and techniques have reached their highest development, particularly in the last few decades. The Canadian weaver, Mary Frame, considers these woven features to be the equivalents of the 'deep structures' of language, in the sense that they tend to characterize woven items in a particular region from one generation to the next, despite intermittent trends in local fashions.[1] The trajectory of these underlying technical phenomena in time and space can therefore inform us about key developments and societal characteristics of Andean civilizations. Such structures and techniques tend to be associated with particular communities of weaving practice, and greater knowledge about them enables us to trace over time the patterns of cultural contacts of these same communities.

A number of studies already describe these warp-faced structures and techniques, but from other points of view. These include *Les textiles anciens du Pérou et leurs techniques* by Raoul d'Harcourt (1934, translated into English in 1962 as *Textiles of Ancient Peru and their Techniques*), then three decades later *The Primary Structures of Fabrics* by Irene Emery (originally written in 1966), followed by *Warp-Patterned Weaves of the Andes* by Ann Pollard Rowe (1977), *Double-woven Treasures from Old Peru* by Adele Cahlander with Suzanne Baizerman (1985), and more recently *Textiles: A Classification of Techniques*, by Annemarie Seiler-Baldinger (1994). Nevertheless, the underlying system of classification in all these classic texts tends to follow a universal classificatory terminology developed in studies on textiles from other parts of the world (Europe, the Middle East and the Far East), and in other kinds of fabric, mainly tapestries, but also silks and other plain weaves of one kind or another (Arnold and Espejo 2012a). Another problem is that most of these influential studies on Andean textiles have been written in French and English, and then translated into other languages, including Spanish, adding to what has been called the 'terminology tangle' by practical weavers in the Andes and elsewhere (Mallett 1986). Above all, none of these major studies has examined textile terminology in Andean languages, let alone the cultural logic of this native terminology, or its consequences in providing a unique way

of understanding the theory and practice of weaving among Andean populations themselves.

Aware of this situation, we sought in this book to revive the terminology and classificatory systems for warp-faced weaves from the perspective of Andean weavers, in a world view perceived from a weaver's fingertips, so to speak. Our aim is to present this alternative world view, expressed in regional weaving terminology and the classificatory system on which it is based, together with the basic definitions of each structure and technique, for a wider public interested in textiles in general, and in Andean textiles in particular. We find that this Andean terminology is highly logical and simpler to grasp than the alternative models available. We draw on the two main living languages in the Andes, firstly Quechua, the language of the Inkas, spoken by some 12 million people from Ecuador down through Peru and Bolivia to Northern Argentina, and secondly Aymara (sometimes written Aimara), spoken by one million speakers around the Peruvian shores of Lake Titicaca, throughout the Bolivian Highlands, and in Northern Chile, with a scattering in Northern Argentina. Uru-Chipaya, the third living language in the region, has fewer speakers, and we mention it only in passing. The Uru-Chipaya 'water people' (with their possible lowland riverine origins) are now located in three main sites: around River Desaguadero which runs south from Lake Titicaca, then around Lake Poopó further south again, and finally around Chipaya pueblo near Lake Coipasa, a salt flat, still further south (see maps 1, 2 and 3). Each of these languages is polysynthetic, in the sense that various suffixes are added on to a basic root word to mark with a logical precision person and tense, direction, and length of time, among other aspects. Over time, each Andean language also developed a rich weaving lexicon since each language group was once comprised of thriving Andean communities of weaving practice.[2]

The reader may ask why this book talks about an Andean 'science' of weaving rather than referring simply to Andean cultural or linguistic practices. The answer is firstly because this book privileges a sharing of knowledge about textiles, in which ideas about weaving practices and the epistemologies driving these practices can be compared scientifically between the Andes, the European and North American weaving traditions, and other textile traditions in the world. Secondly, we consider Andean weaving practices to be an alternative tradition of science, in the sense that the German philosopher Paul Feyerabend develops in his book *Against Method* (written originally in German in 1975). Feyerabend proposes that at any one time various competing traditions generate science. These competing

traditions include scientific research in the dominant paradigms of established disciplines, accepted in the academy, but it also includes other 'alternative traditions', such as the Andean weaving traditions. In fact, it is the dynamic interrelation between these vying ideas that, for Feyerabend, makes the world richer in content, more alive and ingenious than a mono-focus on the dominant paradigms might lead us to understand. So by challenging the established paradigms at the basis of many previous weaving studies, we put forward here a body of alternative scientific concepts as a way of reflecting in greater depth about weaving in this broader global community of practice.

We wrote the first edition of this book in Spanish, aimed at Andean populations, in order to generate the first reflections about its content from within Latin America. Our hope is that this expanded text in English will initiate a much wider debate in the English-speaking world.

THE PROBLEMS AT ISSUE

A scholarly interest in Andean textiles is not new. Andean textiles became the subject of a number of academic studies developed in the last decade of the nineteenth century and first half of the twentieth century, but with approaches typical of their times, which did not always go to the heart of the matter. However, it is important to understand the nature of their contributions, and how their approaches differ from the one in this book.

Early texts on Andean textiles, such as *Dress and Ornaments in Ancient Peru* by Gösta Montell (1929), tended to focus on textiles as dress. Then, in 1930, the North American ethnographer and archaeologist Lila O'Neale, together with the anthropologist Alfred L. Kroeber, published 'Textile Periods in Ancient Peru', in which they privileged the importance of textile techniques (*technics* in their terminology) to identify specific periods and woven styles. Following on from this, O'Neale published a series of technical studies on the archaeological textiles of Nasca and Paracas on the Peruvian Coast (1932, 1936, 1937), before writing the entry on textiles in the *Handbook of South American Indians* (vol. 5, 1949). The extensive contribution written by the North American archaeologist John Howland Rowe to the *Handbook of South American Indians* (vol. 2, in 1943), on 'Inca Culture at the Time of the Spanish Conquest', includes many details about textile production under the Inkas. Other works emerged from the textile industry. For example, the *Diccionario textil panamericano* by J. Rodríguez Ontiveros (1949) defines textile terms in English and Spanish, associated with the kinds of cloth and

designs produced industrially in those years, rather than the underlying structures and techniques of their making.

The studies of later decades on Andean textiles and their techniques were able to draw on these earlier initiatives. Another North American archaeologist, Junius Bird, did pioneering work on 'Techniques' in 1960, in a volume of the *Andean Cultural History* series by Wendell C. Bennett and Bird, and this became a key text for inspiring a new technical approach to archaeological weavings. The doctoral thesis by Mary Elizabeth King, on 'Textiles and Basketry of the Paracas Period, Ica Valley, Peru' (1965), with its emphasis on methods of analysis including the technical aspects, characterized this emerging tendency. Textiles were no longer perceived as finished objects but rather as artefacts with multiple components, each one possibly with quite independent processes in their making.

Other contributions came from weaving experts. One of a new generation of scholars, Ann Pollard Rowe, a researcher at the Textile Museum in Washington, D.C., drew on the universal weaving terminology developed by Irene Emery in her classic *The Primary Structures of Fabrics* (1966), and applied this terminology to specifically Andean textiles in her key book of 1977, *Warp-Patterned Weaves of the Andes*, which is an extremely valuable and enduring text.[3] A few years later, Dorothy Burnham, of the textile department at the Royal Ontario Museum in Canada, drew up a detailed lexicon of textile terminology in English, in her work *Warp and Weft* (1980), with equivalents in several European languages. But again her source was the lexicon already drawn up in 1954 by CIETA (Centre International d'Études des Textiles Anciens), based in Lyons in France, where silk weaving was the main focus of attention. So, again, a universal terminology, and a focus on plain weaves, tended to predominate.

This situation began to change when Sophie Desrosiers, a French expert in textiles and a weaver in practice, whose study area was in the Andes, but whose roots were in Lyons and silk weaving, became conscious of the problem of applying a universal terminology to Andean textiles, as one of the many dangers of ethnocentrism when studying textiles from other cultures (*cf.* 2012). Desrosiers was acutely aware that the extraordinarily precise orientation of each linguistic set of weaving terms is directed towards specific kinds of cloth in each region (Balfet and Desrosiers 1987). This became clear when she analysed a later insert placed at the end of the *Memoria* by fray Martín de Murúa (1590), written partially in Quechua, called to her attention by the Peruvian Ernesto Vargas, who had

already translated the text. As a weaver herself, Desrosiers noticed that this brief entry (which Murúa admitted he did not understand) might be evidence of weaving terminology in the native languages of the region. She put forward the idea that the text represented a warp-faced pattern of counting in a Pre-Columbian belt worn by the Inka empress or Coya, following the colour of the warp pick-ups, where the colours and heddle changes are expressed in Quechua terminology (Desrosiers 1986).[4] This hybrid document is from the Early Colonial Period and possibly forms part of the textile workshop practices from that time which coordinated groups of weavers in their warp pick-up patterns. But at the same time, the counting patterns used are curiously reminiscent of the centuries-old European tradition of inkle-weaving applied to the Andes, 'inkle' referring to narrow belts and bands of this kind in warp-faced, often patterned weaves, woven on an inkle loom.[5]

In her 1986 essay, Desrosiers describes her own effort to replicate this belt by following the indications found in Murúa's text; she compared the results with examples of other Inka belts held in museum collections throughout the world. In this way Desrosiers was able to express her original hunch in a practical woven example. She concluded that the belt could be woven in a double-cloth weave or in certain techniques of selection.

LANGUAGE AND TECHNOLOGY

Our own frustration about developing an appropriate technical terminology for Andean textiles led us to explore more deeply the relation between language and technology in world cultures. We wondered if it was determining in a Sapirian sense or was this relation simply one more facet to the complex world view of each culture. Curiously, the new wave of studies on technique, technology and cultures gives little attention to this relation between language and technology, taking for granted the generalized tendency to derive the etymology of 'technology' (or 'technique') from *téchnê* in Greek from the Old World, without more ado. Even in Europe this approach has its limitations, given the diverse origins of regional technologies. And besides this wide diversity in origins, Marcia-Anne Dobres, a scholar of technologies worldwide, has called our attention to the dramatic changes in the meaning of terms such as *téchnê* in different historical moments (Dobres 2000: 50–53). In the Andes, considering the diverse influences behind technological developments, it is just too much of a stretch (in time and space) to appeal to Ancient

Greek to resolve this question, so we decided to make an effort to seek more regional answers to this problem in general, and to the technical terminology of weaving in particular.

We could not assume that weaving terminology in modern-day Andean languages was the same as in the archaeological past. However, present-day terminology in Aymara and Quechua does present a series of technical terms which, taken as a whole, describe a certain weaving logic, with certain similarities to what the Chilean experts in Andean textiles, Soledad Hoces and Paulina Brugnoli (2006b), call the 'technical alphabet of weaving'. Sometimes, these two languages render the same term to describe a technical element: for example, the term *apsu* in both Aymara and Quechua designates structures and techniques that are 'complex' in their make-up. In other cases, the technical terms in these two languages are distinct: for example, structures and techniques that are 'simple' in their make-up are designated *ina* in Aymara, while the Quechua equivalent is *siq'a*.

Unfortunately, a technological history of the Andes explaining these differences has still to be written, as has a history of science perceived from within the Andean region. We only have the comparative clues, offered by scholars such as Heather Lechtman (who has worked since the 1980s on Andean metallurgy), that, in the Andes, technological solutions to pragmatic everyday questions did not emerge, as in the West, from developments directed towards material aspects, or even towards social differentiation from this technological point of view. Instead, Lechtman proposes that, in the Andes, technological solutions sought the integration (rather than the differentiation) of populations through a productive effort in common, which worked with reference to shared ecosystems, regional resources and raw materials (see in particular her article of 1993 summarizing this idea).[6]

Another striking difference that we could draw on between a more universal view of technology as compared to weaving technology in the Andes concerns the socio-cultural perception of textiles. In the modern world of museum artefacts, textiles are regarded as passive objects, under the scrutiny of curators and researchers. Reinforcing this view, academic approaches to Andean and other textiles, until now, have tended to perceive these artefacts as finished objects, and in this sense as complete 'texts' to be read and interpreted, for example, through a semiotic approach (in Verónica Cereceda's influential essay of 1978). In reality a textile might form part of a much wider and more complex trajectory.

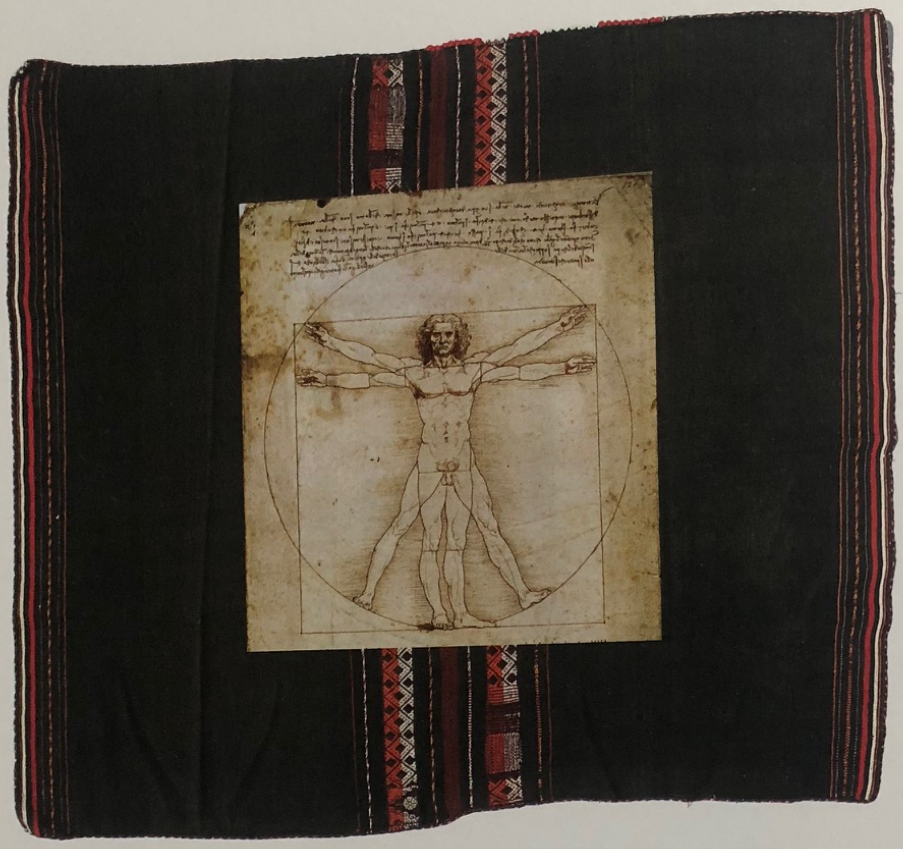

Fig. 2 The person inside an Andean textile (shown here a
Leonardo da Vinci's 1490 sketch of the 'Vitruvius' man).

Here, various elements or components in the making would come to intervene in a series of human lives at one particular moment in time, before they entered a process of decomposition and possibly burial. But then they may have been recovered by grave-robbers or archaeologists, to continue under human scrutiny for a further stretch of time in one of the museum collections of the world (Arnold 2012: 20).

Only recently have anthropologists such as Tim Ingold (2010) criticized the widespread Western world view that perceives objects merely as finished artefacts. Ingold prefers to discard this focus on objects altogether and speak instead about 'things', whose etymology acknowledges their greater sense of engagement in relations between persons, and their vital role in articulating fields of forces during creative acts. In fact, Ingold suspects that the making of all things might derive originally from making textiles.

Andean languages applied to weaving terminology certainly describe a woven thing as if it were a living being (Arnold 2000) (see also fig. 2). In their examination of the techniques of finishing fabrics, Hoces and Brugnoli (2006b) go on to observe how this living nature of weavings

implies the 'personalization of the artefact'. These authors argue that the construction of a textile in itself, and the different modes of the weaving project in which practical solutions arise, also fulfil an expressive dimension for the person weaving this textile, in the composition of its parts, in its iconography and in the application of colour and texture. This would also imply that such techniques of expression can be applied to all stages of weaving.

Interestingly, this distinct philosophical approach towards objects, besides its repercussions in the perceptions of any interaction between human activities and the environment, has implications in the relation between thought, and the technical and technological domains. For Andean populations, textiles are not thought of as passive objects; rather they are beings that interact with the world and have the capacity to animate the relations between individuals and groups of people, including the creation of wider networks of interchange, and of material and spiritual sustainability, between the communities of weaving practice.

This means that the challenge of creativity in the Andes is directed towards achieving a multidimensionality of heart and mind, which permits a weaver as a creator (male or female) to develop things that express this same multidimensionality. The nature of a textile as a living being has to do with its corporality and three-dimensionality. The emerging textile is considered to be a baby on its way to being born. Weavers think that this living being in the making 'eats and digests' the nutritive substances introduced into the weaving space (the 'fell') with each passing across of the weft; likewise a textile as a living being 'breathes in and out' through the textile's 'mouth', which opens and closes with the alternation of the warp sheds (Arnold 2000).

Conceptually, the person who weaves forms a vital part of this multidimensional world, from the moment he or she begins to warp up the loom with each pass of the warp bouts in their figure of '8' movement around the horizontal bars at each end of the loom. And, in practice, the person who weaves simultaneously lives this multidimensionality when he or she begins to apply the techniques of selection and counting (looking down from above) at the elements of the woven construction (warp and weft). Since textiles are conceived as living beings from this first moment of their making, their borders form a fundamental part of the woven construction. The textile must not be cut at any edge and must be 'born' like a body on the loom (Hoces and Brugnoli 2006b). For the

same reason, weavers compare cutting any textile to cutting off a weaver's hands (Arnold with Yapita 2006: 246).

There is a wide range of solutions for establishing the order for comprehending and communicating this 'technological alphabet of weaving'. This is why it is necessary to register and classify woven techniques: in order to define their characteristics and so quantify the frequency and persistence of any technological feature in a particular period or region. And in order to register and classify these techniques we need recourse to Andean languages. In addition, Andean languages express this animate way of thinking about textiles, so that is another reason why it is important to understand regional classification systems about weaving structures and techniques through these languages. It might also be possible that the etymology of weaving terms in these regional languages reveals the history of the technical and technological procedures used in the past and up to the present.[7] We argue that these long-term technical and technological procedures still underlie the biography of each woven thing. Similarly, the semantic aspect of this technical etymology, for example, in the distinct terms for the so-called 'ladder' designs (those called *patapata* or those called *k'uthu*) give us clues about the practical origins of these applied techniques and the social reasoning behind their application in the woven domain in Andean societies in general.

In English, we find the same kinds of relations between technical terminology, weaving practice and world view. We suspect that the insistent reference in British weaving terminology to a single warp and weft, and their conceptualization as single webs or sets of threads that may interact or not, takes us back to the origins of this terminology in the regional practices of plain weaves and tapestry, without patterned design areas. In UK English, the warp threads should ideally be called 'warp ends' and the weft threads should ideally be called 'picks'. North American English is more flexible, but many of these pre-conceptualizations still occur. It is very different in Andean languages, where the terms for warp and weft can have a singular or plural application, and where the interactions between these basic elements can be quite localized in the fabric, and not presumed to extend right across it.

Another technical difference between English and the Andean languages that we had to consider concerns ways of thinking about shot fabrics. In fact, the etymology in English for 'shot' fabrics derives from the term for a weft pass, also called a 'shot' or 'shoot'. This implies that in

English a 'shot' fabric is one in which the weft colour is contrasted with that of the warp. However, some of the Andean techniques for producing iridescent effects in a woven fabric do not just depend on contrasting the weft colour with that of the warp, but may pay attention exclusively to the manipulations of the warp, in so-called 'weaving effects' (Burnham 1980: 25). This is why we decided to distinguish in the book between properly 'shot' fabrics (with a weft effect) and others that are 'speckled' (without a predominantly weft effect).

Similarly, we follow through the Andean world view concerning the living nature of textiles by adopting preferentially the term 'fabric' to describe the interwoven and handmade aspects of these living beings. This is expressed as *sawuta* in Aymara or *away* in Quechua, from the verbs *sawuña* and *away*, 'to weave', respectively. 'Cloth', by contrast, can be non-woven (for example, bark cloth) or else industrially made and then tailored, as expressed by the different terms *isi* in Aymara and *p'axcha* in Quechua for these distinct kinds of manufacture.

Other terminological differences occur in relation to terms about fibre and thread. In English usage, it is common to speak of camelid 'hair', in the same way that we speak of camel 'hair'. The actual fibre in each case usually refers to the soft shorter undercoat of the animal and does not include the wiry outer guard hairs at all. The Argentine archaeologist Andrés Romero (2012) points out how Andean weavers pull out the bristly guard hairs during the cleaning and carding processes of camelid fibre prior to spinning. These guard hairs are then set aside to be used for making ropes, but they are never used for weaving textiles. This leads Romero to make the case for rejecting the term 'hair' in textile terminology when referring to fibre in general, and to use it only in the specific contexts of guard hair use. Andean weaving terminology works in this way, whereby *uywi* in Aymara is a guard hair, whereas *t'arwa* in Aymara or *milma* in Quechua refers to camelid fibre in general. Andean languages also distinguish between camelid fibre, using the terms above, and sheep's wool, using the Spanish *lana*. We follow this distinction between 'sheep's wool' or just 'wool', in English, and camelid 'fibre' here.

Another linguistic distinction to which we pay attention concerns the emphasis given in Andean languages to differentiating between natural yarn, called *ch'anka* in Aymara and *qaytu* in Quechua (which passes into Andean Spanish as *caito*), and a modern industrial yarn (usually nowadays an acrylic yarn), for which the Spanish *hilo* is used. We make this distinction where necessary here, following the differentiation in

English between yarn (as less worked) and thread (as the result of this working).

DIFFERENT CONCEPTIONS OF TEXTILES AS ARTEFACTS

Let us return now to our former point about the differences in weaving terminology derived from approaches to the textile in itself, whether as a finished artefact or as a complex thing in the process of being made. From a methodological perspective, both approaches are useful in the development of weaving terminology, although again it is important to understand the linguistic and conceptual differences between them.

Raoul d'Harcourt (1934 [1962]), Irene Emery (2009 [1966]) and Ann Pollard Rowe (1977) all approach textiles from the first point of view, considering them primarily in terms of museum custodianship, that is, as already finished artefacts. Raoul d'Harcourt (*ibid.*) does not mention textile 'structure' at all, while his view of 'technique' follows universal groupings (reps, tapestry, supplementary weaves, double weaving), which he replicates in diagrams from Andean examples in a key work that is seldom surpassed. For her part, Irene Emery (*ibid.*), long-time curator of technical studies at the Textile Museum in Washington, D.C., gives more emphasis to textile structures than techniques. She organizes these structures hierarchically in terms of the elements or sets of elements in play, from simple to more complex kinds or arrangements, and in terms of the relationships between them. She does this following universal methods and terminology, and in a basically descriptive framework. By textile 'structure' (or 'structural make-up') Emery understands the relationship between threads, either in the repeated interworking of single continuous elements (as in mesh or netting) or the interworking of sets of elements (of warp with weft); she describes what threads do. As a corollary, for Emery textile 'technique' (a term she hardly uses) is simply the outcome of this structure. Rowe tends to follow Emery's lead here.

The more practical approach is developed by Adele Cahlander with Suzanne Baizerman (1985) and by Annemarie Seiler-Baldinger (1994). Cahlander and Baizerman (*ibid.*) provide a very practical as well as theoretical approach to technical procedures, with ample illustrations drawn again from Andean examples. These authors do not mention textile 'technique', but the book concludes that weaving structures are concerned with the number of warp sets used and the detailed patterns of warp manipulation and substitution. Complementing Emery, Seiler-Baldinger (1994) gives importance to the terminology of the technical

procedures, in a universal sense, that intervene in textile making, leaving structures, in Emery's sense, to one side.

Our own focus in this book is to combine both of these previous approaches, in order to offer a terminology that can be applied to the finished artefact or its condition as a textile in the process of being made. We draw our approach here from the way that this close relationship between the processes of making and the finished textile is constantly present in Andean languages. Notably, the Andean perception of a 'way' of learning to weave, which we are familiar with, is expressed in terms of managing ever-increasing complexity. This view is reiterated in the terminology of the finished weaving, according to the same criteria concerning its degree of complexity, and again in relation to the weaving instruments used during textile making, in terms of the weaving complexity towards which they will be directed in practice (Arnold and Espejo 2013a: 83–86).

We follow through this relationship between the processes of making and the finished textile in our close attention to the chain of textile production and within this the operative sequences (a term coined by the French anthropologist André Leroi-Gourhan in 1965), as the locus and organizer of this interrelationship between the technical and technological spheres of weaving production, and the social domain within which the meanings of weavings come to life. In this sense, we understand 'technology' as a set of social relations generated through these interactions between the material and productive aspects of world-making. These relations acquire their specific meanings in the context of particular weaving communities, whose forms of practice have been constructed historically and regionally (Dobres 2000: 61).

On the other hand, we define 'technique' in a general sense as the set of knowledges and practices constructed historically within a region, which are understood at an intellectual and corporeal level, while at the same time they are practised in material contexts and in the sphere of artefacts. This technological interaction between the corporeal and the material aspects contributes to the sense of identity, both of the artefact so generated, and of the participant (individual or group) of a specific community of practice. As a result of these interactions through time, the increasing complexity of material technological artefacts (for example, of looms and their component parts), and their reception in a particular region, would depend on the processes of debate in play (concerning social acceptance or rejection) about their advantages or disadvantages,

between social groupings vying for power through the possibilities of achieving consensus (or imposition) at any one moment.

This approach allows us to appreciate more fully how the different components in a textile's construction as a complex thing might derive from distinct sources (in regional resources and their conversion into raw materials). It also facilitates our understanding of how these multiple components have often been submitted to distinct treatments in the processes of gathering or extraction, followed by the working of basic regional resources (fibre from animals) into raw materials (fleece) and then through later transforming tasks (shearing, spinning, plying, dyeing), even before starting on the processes of making cloth (through warping up, weaving and finishing of one kind and another). All these processes in their totality constitute the 'chain of textile production' and, if we add to this the dimension of human activity in textile making, we can now speak about the textile operative sequence or chain (*chaîne opératoire* in Leroi-Gourhan's 1965 terminology). This book pays close attention to the operations in these chains and in this sense continues the themes of our previous books *Ciencia de las mujeres* (Arnold and Espejo 2010) and *El textil tridimensional* (Arnold and Espejo 2013a). In this book we examine in more detail the processes of warping up and weaving as two vital aspects of making textiles, reinforced by the pertinent technological developments in the loom, loom furniture and loom instruments.

STRUCTURE AND TECHNIQUE IN THE ONTOLOGY OF THE WOVEN ARTEFACT

In the processes of making textiles, this book insists on the importance of warping up and weaving as two closely related and determining activities in this wider productive chain, in the first place because the warping-up techniques generate the textile structure and in the second because the later techniques of selection and counting out the warp threads derive from the possibilities facilitated by the textile structure already laid out. Only by completing these two intimately related processes can a weaver create the textile motifs, designs or figures, whose possibilities of expression equally depend on the woven structure and techniques already set into motion during the making process.

Only from there on can the expressive techniques for making the textile iconography be applied, through either solitary motifs, or those organized in groupings of blocks or scenes, with their distinct attributes (Arnold, De Diego and Espejo 2014). And these designs, in turn, are organized

within the wider patterns of textile composition (with their sequences, directionality, symmetries and scale) already preconceived during warping up in the layout of their components (whether in bands, stripes, segments or panels). Although the initial techniques for the application of colour have often been carried out already in an earlier stage of dyeing, there is still the composition of colour to organize, in layers, contrasts, ranges of tonalities and the juxtaposition of clear and dark colours, and shades of colour.

Tim Ingold (2010: 92) has rightly criticized the age-old 'hylomorphic' model, which views such creative practice as imposing 'preconceived forms on inert matter', in favour of perceiving skilled practice as a participatory act in an ongoing transformational flux, through a shifting world of materials: in the view from the weaver's fingers. This transformational view implies that matter is *performed* into being through practice. It implies that images, too, are not static elements to be analysed *ex post facto*, but rather that they are productive of reality, and not simply assigned sets of meanings or representations when they become finished objects (if they ever do). Even so, it is just as important to consider how weaving, in practice, especially in the case of complex garments with complex structure and techniques, does demand the mental planning of what has been calculated as some 80 preliminary strategic operations in looming up, organizing the weaving structure, locating the compositional elements and planning the techniques to be applied, before weaving ever begins (Franquemont, Franquemont and Isbell 1992). And all of these preparatory tasks, mental and manual, are just as much a vital part of the wider technical enterprise of weaving practice.

Likewise, it is necessary to understand that a single textile can include many different techniques in its overall composition, and even a variety of counting techniques in one single design band. There can be additional variants on these counts in some rows during the making of a woven motif. However, our point of departure here is that modern weavers recognize a determining count that prevails in the textile as a whole. This determining count defines the general counting patterns that the weaver applies, the visual rhythm of the motif patterns that emerge, and to some degree the types of motifs woven, as these derive from the specific counting techniques. Similarly, the techniques of selection and counting out the warp threads during the weaving process, following the predominant patterns of counting in odd or even counts, derive from the expressive possibilities of opting for more 'figurative' or more 'geometric'

iconographic motifs, each pattern group giving rise to a world of other creative possibilities (Arnold and Espejo 2013a, Chapter 6; Arnold, De Diego and Espejo 2014).

It is our contention that in the remote past these pick-up counts were less determining and that there was a less disciplined application of these counting groups in general. Ordered pick-up counts were still incipient. However, the evidence from archaeological textiles on the Coast of Peru shows a greater attention to these counts by at least the Early Intermediate Period (200 BC–AD 600). From then onwards, regional cultures, and indeed archaeological textile styles, become identifiable by the counting patterns they tended to adopt. At the other extreme of this time sequence, in the modern period, while state schooling in Andean countries has not recognized weaving much as a valuable activity, nevertheless we suspect that mass education from the 1960s onwards, with the more systematic classroom teaching of basic arithmetic to young weavers, has been the vital incentive for the highly disciplined application of counting patterns and the drive for technical innovation over the past five decades in rural communities. These determining patterns are what interest us here. They provide our reference point for our enquiry into the relations between technical practices, weaving practices and cultural practices throughout this book, and for establishing a new classification of textile techniques based on the technical practice of weavers themselves.

Given the importance of these determining weaving structures and techniques in the ontology of textiles as objects (and as subjects), a greater systematizing of these aspects, together with a better comprehension of their relevance in regional terminology, permits us to compare these technical and technological aspects of textiles in terms of space, in different regions, of time, in distinct periods, and of cultural practice, in the cultural filiation of prevalent combinations of structures and techniques in certain localities through time.

This technical understanding also offers us the possibility of comparing the use of common structures and techniques between different kinds of fibre supports, for example, between warp-faced and weft-faced weaves, and of comparing these forms of woven construction in embroidery and brocades, in different regions, periods and cultures. For example, it is particularly interesting to explore in greater depth the relation between developments in warp-faced weaves and those of embroidery in Early Horizon Paracas (900–200 BC), on the South Coast of Peru (as we do in the section on reselected techniques later in the book). Highlighting

this technical understanding also gives us important clues as to how to recognize underlying weaving structures and techniques in other kinds of material supports, for example, in rock art, ceramics and architecture (Rivera in press).

As a consequence of this deeper understanding of textile structures and techniques over time, we could determine more precisely the region or period of development for specific woven examples from the museum textile collections with which we have been working. This is a vital help in the constant search for a greater contextualization of museum artefacts during the processes of registering and cataloguing textiles, which is another underlying problem we had to face in practice (Arnold with Espejo and Maidana 2013).

There are many preconceived ideas about differences between archaeological and ethnographic textiles, for example, presupposing that there is the use of a single weft in archaeological examples as opposed to the use of two wefts in contemporary ethnographic textiles and the use of one single face in archaeological textiles as opposed to two-faced fabrics in present-day examples. The new model of woven structures and techniques we present here permits us to question these preconceived ideas with specific examples that present us with other alternatives for consideration, for example, the evidence for the use of two weft sets in funerary double weaves from the Pre-Columbian Period, as well as in the Colonial Period, for certain kinds of double-cloth weaves.

TEXTILES IN ANDEAN SOCIETIES

One characteristic of our systematizing of woven structures and techniques in the Andes, based on Andean languages and practice, is that we organize the groups of examples from the most simple (Aym. *ina*; Qu. *siq'a*) towards ever greater complexity (*apsu* in both languages). We do not intend to give the impression that all weavers in a given historical period knew and practised all the examples presented here. Rather, the access for weavers to a range of technical options at any one moment depended on the regional history of textile production. It depended just as much on technological developments in looms, loom furniture and weaving instruments, and the multiple influences, both internal and external, in regional styles as well as in tributary demands or in those of the market, all of which influence the various stages of the textile productive chain, and the socializing customs concerning the circulation of finished textiles in Andean societies (Arnold 2012).

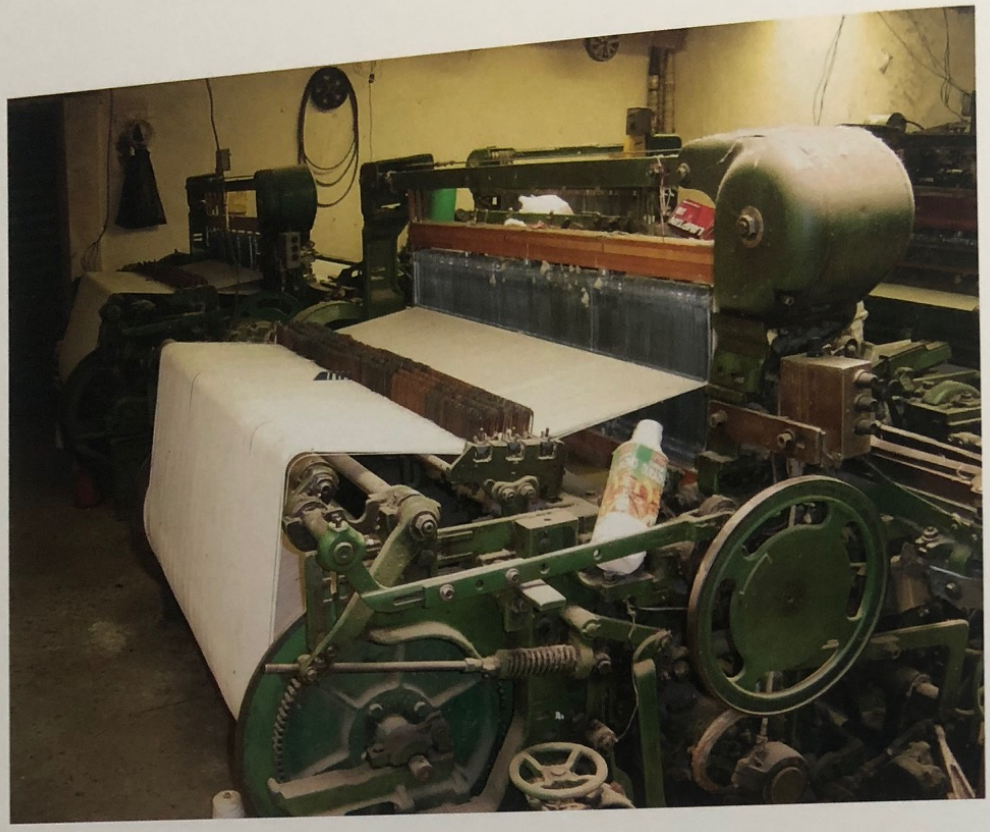

Fig. 3 Mechanical looms in a worksh

In the past, and still to some degree today, access for any one individual to these technical options depended on their sex, age and status in a given society. Evidently, the democratizing of access to raw materials and to technological and technical information regarding weaving production in the Andes is a relatively recent phenomenon (Arnold and Espejo 2012b: 186–88, 197). If we go back three or four generations, we are already in a world riddled with restrictions to this access, which is much more dependent on the sex, age and status of a weaver than it is today, and where a major part of textile production was still in the hands of specialists. This situation also covers access to particular weaving structures and techniques, which only a privileged class could practise and, even then, through the intervention of specialists in each field, whether in textile making or in the composition of designs and colour. We describe elsewhere the Andean terms for the former division of people into status groups called *ina* (simple, ordinary, of a lower class) and *apsu* (privileged, select, upper class), with rights to the use of garments with simple or complex structures and techniques respectively (Arnold and Espejo *ibid.*). For their part, we suspect that many of the remaining specialists in each of these fields, who still recall these divisions within their social memory, were descendants of these specialized work groups according to state demands in past centuries

in a form of textile production destined towards tributary and sumptuary circuits (*ibid.*).

At the beginning of the twentieth century, this situation changed radically. Multiple facets of the former operative and productive chains were changed by the industrialization of textile production in cities, within the context of a more generalized economic globalization, accompanied by the semi-industrialization of textiles in provincial centres (fig. 3). This was together with the demand for an indigenous form of textile production directed at the tourist market, in what came to be called 'handicrafts' (Sp. *artesanía*) or 'indigenous art' (Sp. *arte indígena*), combined with the invention of the ethnic style as part of a process of national integration. These demands exacted a massive workforce and a democratizing of the whole productive endeavour, partially in the hands of the NGOs that work in this field. But although these developments in artisanal manufacture provided a modest income for the participants in marginal economies in the region, as a result there was a tendency to simplify the finished product, as well as the processes and techniques during its manufacture.

In this context, we offer here information previously accessible only to weaving specialists in the Andean region, with the hope of contributing to the rescue and revaluing of the former technical and technological complexity of Andean weavings.

THE BASIC DEFINITIONS

Given this wider perspective, let us take up again our preliminary observations about the limitations of current textile technical terminology, which in the studies by Emery and Rowe was oriented towards the museological analysis of a finished textile object (a textile as artefact), or, alternatively, in the study by Seiler-Baldinger, of the textile as an object composed of multiple components in the making. In brief, how can we combine both approaches in one single terminological framework? And, in order to do so, which principles should we follow?

Basing our approach on the terminology used by weavers themselves in the region, we have opted for the following basic definitions:

Textile structure refers to the ways of organizing the structural basis of a particular fabric, either through the interworking of single elements or through the warping up process (Aym. *tilata*; Qu. *allwina*) where warp

and weft sets are used, using a formal loom or a more rudimentary instrument. In the case of warp-faced weaves, the structure is formed by the warp layers set out in the warp bouts in their figure of '8' pattern, as the warp threads are passed during warping around the horizontal bars at either loom end (or a set of equivalent rods in a pre-loom situation). In the case of weft-faced weaves, the structure is similarly given by the forms of warping up a textile in layers through the warp-bout figure of '8' patterns of the warp threads around the horizontal loom bars (or a similar set of rods in a pre-loom situation).

Textile technique(s) (with their specific terms in Aymara and Quechua) derive from the weaving structure already in place. These are the orders for managing the dominant threads that define the different textile surfaces. In the case of warp-faced weaves, they are the forms of selecting and counting the warp threads before passing across the weft thread in each row of the fabric. In the case of weft-faced weaves, they are the forms of organizing and selecting the weft threads.

TECHNIQUES OF TEXTILE MAKING

By 'techniques of textile making' we refer to the specific ways that each community of weaving practice – including individual weavers – resolves the technical problems that present themselves during weaving and helps resolve these problems expressively.

In other words, although there is a given range of textile structures and techniques in general use in a region, each community of weaving practice develops its own 'techniques of textile making' to carry them out, as does each practising weaver, given the technological and technical resources available at any one time, and given the social and economic framework of textile production in which they work.

Within the sequencing whereby these techniques of making occur within the stages of weaving practice, we identify six principal categories: structural techniques, weaving techniques, techniques of selection and counting, techniques to produce shot and speckled effects in the fabric, techniques of expression and finishing techniques.

Structural techniques are the strategies for arming and then adjusting (or gating) the loom, including warping up, ordering the warp and weft layers, and ordering the layers of colour.

Weaving techniques are the general strategies for ordering the selection and counting of the warp threads (in plain weave, ladder techniques, selected and reselected techniques, and that of double-cloth weaves) to produce the distinct types of warp-faced weaves, or that of the weft threads to produce weft-faced weaves. Weaving techniques also determine the kinds of woven construction.

Techniques of selection and counting are the strategies for selecting the warp threads, counting the dominant threads, passing the weft and the general managing of the loom instruments (the heddle sets, the wooden poles and swords, beaters and separators, as well as the bone or wooden separators called *wich'uña*, and the fine selectors of wood or metal, called *jaynu*).

Techniques to produce shot or speckled effects in fabrics are the strategies used in the stages of selecting fibre or wool, spinning and plying, warping up and weaving, to achieve the diverse shot or speckled effects (Aym. *ch'imi* or *ch'imita*; Qu. *ch'imisqa*), whether through the manipulation of colour in the fibre or wool, of colour in the make-up of the threads, of colour in the threads of the warp selection, or the combination of warp and weft colours, and the relative density of warp and weft.

Techniques of expression are the strategies for generating the textile images or motifs. They include questions of universal or regional style, technological style, composition, iconography, techniques for the application of colour, and so on.

Finishing techniques are the ways of resolving the textile joins, seams and borders in both the external and internal woven edges, whether in simple textiles or in complex textile constructions with multiple components.

In this book, we develop detailed sections on the structural and weaving techniques, and then on the techniques of selection and counting. We omit a detailed examination of the finishing techniques, whether of sewing seams or finishing borders and edges, since the book *Manual de técnicas textiles andinas. Terminaciones*, by Hoces and Brugnoli (2006b) offers an excellent introduction to this theme. A more detailed examination of the techniques of expression, including a weaver's view of woven composition, can be found in our book *El textil tridimensional* (Arnold and Espejo 2013a).

METHODOLOGY OF WORK

In order to arrive at these definitions, our methodology of work required the examination of weaving terminology in distinct communities of Aymara- and Quechua-speaking weavers. Working closely with weavers from various regions in the South Central Andes, we gradually developed an understanding of this terminology in Aymara and Quechua languages, and this lexicon served as the primary data for this study.

In Bolivia, we explored weaving terminology in the regions characterized by their *ayllu* communities, located in Northern Potosí (Llallagua, Laymi, Jukumani and Sacaca) and Southern Oruro (Qaqachaka, Condo, Aguas Calientes and Challapata) and in rural communities in the Departments of Cochabamba (Bolívar) and La Paz (in the Islands of the Sun and the Moon, Compi, Ayata, Mollo and Charazani). In Peru, we examined weaving terminology in Cusco and nearby (in the communities of Pitumarca, Chinchero and Chawaytiri). In Chile, we examined the weaving terminology of Isluga and, with the help of the Chilean archaeologist Bárbara Cases and educational expert Carla Loayza, in Colchane, Pisigacarpa, Pisigachoque, Central Citani, Escapiña and Enquelga (see map 3, p. 47).

Other primary data comes from our reading of the classic studies on weaving terminology (D'Harcourt, Emery, Rowe, Cahlander, Seiler-Baldinger, Desrosiers and many others), on the methodological proposals applicable in the field of textiles (Gavilán and Ulloa 1992), on advances in efforts to agree on weaving terminology in Spanish in a work group in the Jornadas Internacionales sobre Textiles Precolombinos, coordinated by Rosa Fung (2002) and Ann Pollard Rowe (2006), and in long periods of learning how to register and examine textile collections, with archaeological, historical and ethnographic samples, in a dozen museums in the UK and Latin America.

We worked in a multidisciplinary team. The vital knowledge of the weaver Elvira Espejo (fig. 4) and the help of her assistants from different Andean regions was invaluable in systematizing the preliminary and then more definitive models of weaving structures and techniques. Espejo's working models of these in a series of replicas in maquette, many of which are based on pattern sticks used the world over for making working models of this kind, provide many of the supporting illustrations throughout this book. Denise Arnold contributed as anthropologist in systematizing the terms and contextualizing them according to their social and cultural meanings, and as an ontologist in the development

Fig. 4 Elvira Espejo working at the British Museum in London with Helen Wolfe, head of the Textile Department.

of models of the sequences of increasing complexity of weaving structures and techniques and as a corollary, in the learning sequences. These models were prepared initially in Excel spreadsheets, then in mental maps using the software programme CmapTools and later on ontologically in the programme yEd Graph Editor. The coincidence between these two organizing criteria – sequences of complexity and sequences of learning – in which small girls first learn the techniques of crossed warps, before going on to manage other warp-faced techniques, is what led us to include the range of crossed-warp weaves within the warp-faced techniques. The constant debates between us concerning such decisions helped us gradually to refine the conceptual models from hypothetical to more stable schemes, which we continually put under the scrutiny of our

colleagues. We presented a first version of the model of systematization of textile structures and techniques in the V Jornadas Internacionales sobre Textiles Precolombinos, and then in the essay 'Hacia una terminología textil andina: una introducción' in the *Actas de las V Jornadas de textiles precolombinos*, edited by Victòria Solanilla (Arnold and Espejo 2012a).

One consequence of our ontological work, combined with the need to digitalize the categories we developed, was the decision to register textile colours in terms of a relatively limited set. This set respects the main colours identified by the weavers we worked with and the three tones that tend to emerge as a result of the three immersions in the dye baths generally practised during the dyeing process. This is why we tend to describe the dark, intermediate or lighter tones of a limited set of colours (red, blue, orange, yellow, green, indigo, purple, violet) and of natural fibre colours (black, brown, grey, white, tan and so on), rather than using more arbitrary personalized terms such as pink, turquoise or kingfisher blue.

We were also compelled to be rigorous in the way we described a textile's dimensions. In the examples of warp- and weft-faced fabrics, our ideal would be to annotate firstly the warp direction and then the weft direction. In examples of balanced weave, we prefer to give the vertical axis dimension first and then the horizontal dimension. In the case of tunics and bags, and so on, where the fabric is doubled up and then sewn to form the final garment or accessory, we also give the overall dimension of the original piece before it was folded.

Other instruments of analysis that we developed, refined and then applied in practice throughout the 'Weaving communities of practice' project were two software programmes. The first, Sawu-3D, was developed more with technical colleagues in ILCA in La Paz, Bolivia. We worked on the second, Sawu104, from scratch with technical colleagues at Birkbeck at the University of London.[8] The development of the Sawu-3D programme from the year 2006 onwards helped us systematize the language and logics we were using in relation to textile construction. In particular, the drawing of these constructions in order to replicate weaving structures and techniques in two-dimensional images on the computer screen, and their simulations in 3-D, went hand-in-hand with new research questions about the number of warp and weft layers used in certain museum textiles. Finally, as we prepared sketches of the manuscript for the book, we were able to prepare a supporting library of different kinds of images (models, maquette replicas, photos, videos and drawings in the

Sawu-3D and Sawu104 programmes) which could illustrate each one of the structures and techniques involved.

So although our methodology was directed towards a systematization of textile terminology, which was as much scientific as it was anthropological, we could still apply in practice the methods of 'grounded theory', in which you develop hypothesis after hypothesis of work before arriving at the final model of the problem under scrutiny. And even then, we left open the possibilities of refining our model further, should we encounter new structures and techniques in museum collections or in the communities of weaving practice.

As a final comment on our ways of working, insofar as we were engaged in a process of mutual learning about approaches to weaving, without predetermined commitments to overriding theories or ways of working, but willing to develop *ad hoc* methodologies that enabled us to work together towards a common end, it was indeed a truly intercultural experience. Struggling at first with differences of opinion and understanding, compounded by the fact of working through various languages, we managed to consolidate this new systematization of textile structures and techniques, and share it here with others.

ORGANIZATION OF THE BOOK

Following on from this introduction, the book begins with Part 2 entitled 'A new modelling of Andean textiles', which explains the reasoning behind the alternative model we propose for weaving structures and techniques in Andean warp-faced weaves. Part 3 describes 'The way of learning to weave', through the 'Stages of Learning' still practised in Andean rural communities, as young girls organized in age and sex groups learn to weave warp-faced structures. During these stages, they proceed from simple to more complex textile structures and techniques, in a logical sequence from preliminary and simple examples to the most complex and advanced ones. Part 4 'Textile structures and techniques' sketches the principal groups of structures and techniques we identify in warp-faced weaves, from the most simple to the most complex types, with descriptions of each major set of weaving techniques, complemented by illustrations of examples in each case. When it is pertinent, we specify the type of loom employed to make specific structures and techniques. In each technical entry, we follow approximately the same scheme: description, structure, techniques and the type of loom for each technique applied.

Years	Argentina	Bolivia	Chile	Peru
2000	**Late Republican** (1900–present)	**Late Republican** (1900–present)	**Late Republican** (1900–present)	**Late Republican** (1900–present)
1900	**Early Republican** (1825–1900)	**Early Republican** (1825–1900)	**Early Republican** (1825–1900)	**Early Republican** (1825–1900)
1800	**Late Colonial** (1780–1825)	**Late Colonial** (1780–1825)	**Late Colonial** (1780–1825)	**Late Colonial** (1780–1825)
1700	**Early Colonial** (1535–1780)	**Early Colonial** (1535–1780)	**Early Colonial** (1535–1780)	**Early Colonial** (1535–1780)
1600				
1500	**Late Horizon/Late** (1420–1535)	**Late Horizon/Late** (1430–1540)	**Late Horizon/Late** (1420–1535)	**Late Horizon/Late** (1400–1535)
1400				
1300	**Late Regional Developments** (AD 1200–1420)	**Late Intermediate** (AD 1000–1430)	**Regional Developments/ Late Intermediate** (AD 900–1420)	**Late Intermediate** (AD 1000–1400)
1200				
1100				
1000	**Early Regional Developments** (AD 900–1200)	**Middle Horizon** (AD 400–1000)		**Middle Horizon** (AD 600–900/1000)
900	**Late Formative** (AD 400–900)		**Middle Period** (AD 400–900)	
800				
700				**Early Intermediate** (200 BC–AD 600)
600				
500				
400	**Early Formative** (1600 BC–AD 400)	**Late Formative** (200 BC–AD 400)	**Late Formative** (300 BC–AD 400)	
300				
200				
AD 100				
0				
100 BC				**Early Horizon** (900–200 BC)
200		**Middle Formative** (800–200 BC)		
300			**Early Formative** (1800–300 BC)	
400				
500				
600				
700				
800		**Early Formative** (2000–800 BC)		
900				**Initial** (2000–900 BC)
1000				
1100				
1200				
1300				
1400				
1500				
1600	**Pre-ceramic** (8000–1600 BC)			
1700				
1800			**Late Archaic** (4000–1800 BC)	
1900				
2000		**Pre-ceramic** (8000–2000 BC)		**Late Pre-ceramic** (3000–2000 BC)
2200				
2400				
2600				
2800				
3000				**Early Pre-ceramic** (10000–3000 BC)
4000			**Middle Archaic** (6000–4000 BC)	
6000				
8000			**Early Archaic** (8000–6000 BC)	
10000			**Paleoindian** (10000–8000 BC)	

Fig. 5 Chart of archaeological and historical periods by country.

The set of simple techniques in warp-faced weaves worked on a framework of rods instead of on a loom begins with the range of crossed-warp techniques, which small girls learn in tiny belts and braids, before going on to learn more complex techniques. This group also includes the set of techniques of transposed warps. Then we pass on to the simple structures and techniques made on basic looms in plain weave (*ina sawu*), which include the techniques of balanced weave, in the traditional techniques of herringbone, twill or serge (Sp. *jerga*), the semi-industrial woollen flannel or baize (Sp. *bayeta*) and its looser sacking-like counterpart (Sp. *sacaña* or *sayal*). After this, we examine the ladder structures and techniques, with their two principal variants (*k'uthu* and *patapata*), and the techniques of warp manipulation, whether discontinuous warp or discontinuous warp and weft.

The analysis of the set of complex techniques, now made on complex looms, opens with the selected techniques (Aym. *palla*; Qu. *pallay*), with their techniques of selection and counting, equivalent to 'float weaves' in the terminology of former studies. From there, we pass to the group of techniques (called *tika* in the Andean languages) that give attention to alternating between sets of light and dark colours. Then we pass to the reselected techniques (Aym. *ajlliña*; Qu. *aqlliy*), formerly called 'supplementary weaves', with their variant called *qhusi*, again centred in the manipulation of light and dark colours, but this time they are organized through two distinct technical processes. This section ends with the simple and complex techniques of double-cloth weaves. This sequence of weaving structures and techniques is illustrated in a series of tables and diagrams.

The book includes a glossary of key terms in Andean languages (Quechua and Aymara) and in Spanish, with English glosses, and charts to designate the forms of counting and textile terminology in these Andean languages, with their equivalents in English and Spanish. In the first entry of the terms corresponding to a new structure or technique, we include the equivalents in Aymara, Quechua and Spanish. However, as the text develops, we opt to include only the English and Aymara terms; the equivalents in Quechua are consigned to the lists of equivalents in the tables.

We use a colour coding in the book to identify each set of techniques and help the reader locate them. We are aware that weavers will wish to locate the details of woven techniques within the overall textile form and so in this English edition we include additional images to indicate this. In

the case of textiles held in the British Museum, we also cross reference our detailed images to whole textiles that have been documented in the book *Textiles from the Andes* by Dransart and Wolfe (2012).

The book includes a general map (map 1) and archaeological and ethnographic maps (maps 2 and 3) of the site of textile production mentioned in the text, a chart of the main archaeological and historical periods to which we refer throughout (fig. 5), a figure of the types of woven construction (fig. 8) and tables showing the models of textile structures and techniques we developed, with their forms of selection and counting, in English, Spanish and the Andean languages Aymara and Quechua (figs 10, 11, 16, 17, 69, 70 and 330). Our terminology for the textile styles, and associated regions and periods, was developed during the AHRC project, with the caveat that defining these at all is an extremely tricky task with so little provenance information for the main part of museum textiles. We define our time chronologies into the archaeological period (10,000 BC–AD 1532) with its range of subdivisions, the historical period (AD 1532–1900) with its subdivisions into the Early and Late Colonial, and the Early Republican periods, and finally the ethnographic or Late Republican period (1900–the present). The volume ends with the references and indices of personal names and site names.

The book contents are linked to the internet site 'Weaving communities of practice' developed at Birkbeck, University of London (http://www.weavingcommunities.org), for which we provided most of the study materials, including short video clips illustrating weaving techniques, although we were not personally responsible for the site design.