Survival and signaling: An assessment of environmental and social influences on the richness and complexity of hunter-gatherer clothing

by

Jonathan Harding

B.A. (Hons.), Simon Fraser University, 2017

Thesis Submitted in Partial Fulfillment of the
Requirements for the Degree of
Master of Arts

in the
Department of Archaeology
Faculty of Environment

Declaration of Committee

Name:	**Jonathan Harding**
Degree:	**Master of Arts**
Title:	**Survival and signaling: An assessment of environmental and social influences on the richness and complexity of hunter-gatherer clothing**
Committee:	**Chair: Dana Lepofsky** Professor
	Mark Collard Senior Supervisor Professor
	Dennis Sandgathe Supervisor Lecturer
	Jon Driver External Examiner Professor

Abstract

Despite clothing's importance and antiquity, cross-cultural variations in clothing complexity have not been adequately quantified. This study aims to build on existing quantitative methods for understanding which variables drive clothing variation. To that end, I gathered data on clothing from 50 small-scale ethnohistoric hunter-gatherer societies, along with information on their environments, economies, social structures, and demographics. With these data, I tested several hypotheses that may predict cross-cultural variation in clothing complexity: the Environmental Hypothesis (primarily related to thermoregulation); the Economic Hypothesis (related to subsistence and movement patterns); the Social Hypothesis (related to sexual dimorphism, freedom, polygyny, and violence); and the Population Hypothesis (related to population size and density). Results indicate that temperature and related variables are the primary drivers of wardrobe richness and clothing complexity, but male-male competition plays an important role in predicting richness of decorative clothing. Subsistence and population-related variables play minor roles as well.

Keywords: clothing; wardrobes; decoration; climate; technological evolution; material culture; ethnology; ethnography

Acknowledgements

Thank you to Prof. Mark Collard for all of your feedback and support throughout the entirety of my last several years of research and writing. You probably didn't expect me to write a novel-length thesis, but it turned out pretty well, I think. Thank you to Dr. Dennis Sandgathe for your feedback and support, particularly with regard to lithics. They're not my speciality, and without your expertise on that topic, this project would've turned out a lot weaker. Thank you to Prof. Jon Driver for your input in the last stages of editing. There are several important concepts and ideas written throughout my thesis that are there specifically because of your feedback. Thank you also to my friends and colleagues in the Grad Lab. Thank you also to the SFU Department of Archaeology for your support and your creation of an open, stimulating learning environment.

And thanks to Aleks for your love, and above all, your patience.

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Chapter 1.

Introduction

Despite its obvious importance for human survival and reproduction, clothing has received relatively little attention from evolutionary-oriented anthropologists. To date, only half a dozen papers (Collard et al. 2016; Hayden 1990; Gilligan 2007; Glass 1966; Hayden 1990; Wales 2012) and one book (Gilligan 2018) have focused on the role of clothing in human evolution. Not surprisingly, the paucity of research means that there are some major gaps in our knowledge. One of these concerns the cross-cultural variation in the richness and complexity of the items of clothing used by small-scale societies. Following Collard et al. (2011a; 2013), 'richness' here refers to the number of types of garments employed by a society, while 'complexity' refers to both the number of components of an individual type of garment and the total number of components among the various types of garments that form a society's wardrobe.

It is clear from even just a handful of photographs of traditional societies from different parts of the world that both the number of types of garments and the complexity of individual garments varied markedly among such societies. Some societies used just two or three simple items of clothing, while others utilised a wide array of garments, some of which were made of dozens of individual elements. However, the scale of the variation is unclear. This is because the variation in the complexity of the clothing of small-scale societies has yet to be quantified.

The causes of the variation in the complexity of the clothing of small-scale societies are equally poorly understood. It is obvious that multiple factors influence humans' choice of clothing. Some garments were unquestionably designed to allow humans to cope with the elements, but others clearly have different functions, such as displaying group affiliation and signaling an individual's status within their social group. To complicate matters further, many items of clothing have more than one function. At the moment, however, we do not have an adequate grasp of the relative importance of the factors that influence clothing richness and complexity. This is because the issue has not been investigated.

The study reported in this thesis attempted to shed light on both of these issues, i.e. both the scale of the cross-cultural variation in the richness and complexity of the items of traditional clothing used by small-scale societies, and the factors that influenced that variation.

In the study, I quantified clothing with a method that the anthropologist Wendell Oswalt developed for analysing the structure of traditional subsistence toolkits (e.g. Oswalt 1972; Oswalt 1976). The foundations of Oswalt's method are the subsistant and the technounit. Subsistants are the food-gathering tools themselves (e.g. a spear, a net, or a deadfall trap), while technounits are the tools' structurally unique components (e.g. the stone tip of a spear or the binding that secures the stone tip to a wooden shaft). Summing the number of subsistants in a toolkit provides a measure of the toolkit's richness, while summing the number of technounits a toolkit contains provides a measure of its complexity. A toolkit's complexity can also be represented as the average number of technounits per subsistant.

Oswalt's method has been used repeatedly over the last 50 years. Oswalt himself employed it to explore the relationship between toolkit complexity and the nature of the food resources relied on by small-scale societies (Oswalt, 1972; 1976). Subsequently, it has been utilised to test the hypothesis that risk of resource failure drives the variation in toolkit richness and complexity among hunter-gatherers (Collard, et al., 2005, 2011a, 2013; Read 2008; Torrence 1983, 1989) and the hypothesis that demography governs technological complexity in small-scale societies (Collard et al., 2005, 2013, 2016; Vaesen et al., 2016). It has also been used to test the hypothesis that niche construction is an important process in human history (Collard et al., 2011b). In addition, Oswalt's method has been employed to analyse the subsistence technology of chimpanzees (McGrew, 1987) and capuchins (Westergaard 1994).

I opted to use Oswalt's method because it allows for fine-grained evaluation of both individual garment types and wardrobe. Hayden (1990) and Gilligan (2007) developed ways of classifying garments, but they are too coarse for the task at hand. Hayden (1990) recognised three types of garments, 'basic capes', 'improved capes', and 'luxury garments', while Gilligan (2007) simply divided garments according to whether they were 'simple' or 'complex'. While both of these classificatory systems are valid, neither allows for detailed analyses of cross-cultural variation in garments and wardrobes because they lump together garments of very different designs, intricacy, and uses. In contrast, Oswalt's method allowed me to identify subtle differences among the clothing types and garments used by the societies in my sample. This in turn allowed me to characterise the cross-cultural variation in the sample and to test a series of hypotheses concerning the drivers of cross-cultural variation in clothing. Significantly, in a paper published in the late 1980s Oswalt extended his method to a number of non-subsistence technologies including clothing (Oswalt 1987). So, there was precedent for my choice of method.

For the purposes of the study, I employed an inclusive definition of clothing. As a starting point, I used Gilligan's (2010a:17) definition of clothing, which is "items that act to enclose or cover the body". I elected to treat pieces of jewelry such as necklaces, bracelets, and rings as clothing alongside jackets, shoes, hats, and so on because the everyday distinction between jewelry and clothing is arbitrary under Gilligan's (2010a:17) definition. For example, both a necklace and a decorative scarf act to cover the neck. The only differences between them are their thickness and the material from which they are constructed, and neither of these is relevant to the definition. I treated body paint and hair oil as clothing for the same reason.

I tested four hypotheses in the study. They are as follows:

- The Environment Hypothesis—This hypothesis contends that cross-cultural variation in clothing richness and complexity is driven by the need to mitigate harsh climatic conditions such as low ambient temperature. According to this hypothesis, cultures living in colder climates will tend to have more complex clothing, whereas cultures living closer to the equator will tend to have less complex clothing. Furthermore, cultures experiencing more precipitation will use purpose-made garments for mitigating its effects, and will thus have richer wardrobes.

- The Economic Hypothesis—This hypothesis argues that cross-cultural variation in clothing richness and complexity is influenced by economic factors, especially subsistence strategies, food storage techniques, and degree of mobility. Subsistence strategies can be expected to influence a culture's reliance on the need for ranging far from home areas (Kelly 1983). Moreover, subsistence strategies that require relatively small home ranges (i.e., gathering) should constrain wardrobe size and limit a group's ability to carry relatively bulky clothing (Shott 1986). Likewise, degree of mobility and food storage techniques ought to influence the proximity of a culture to its food, and therefore, perhaps, its reliance on complex clothing.

- The Social Hypothesis—This hypothesis avers that cross-cultural variation in clothing richness and complexity is influenced by marriage practices and/or frequency of warfare. Violent societies ought to require more ostentatious clothing due to their relatively high levels of male-male competition and war (McDermott et al. 2018; Schacht et al. 2014; Wilson and Daly 1985). Furthermore, polygynous societies ought to concentrate wealth in the hands of relatively few people (Sanderson 2001), therefore allowing—and perhaps requiring—those few to display their wealth in the form of ostentatious clothing.

- The Population Hypothesis—This hypothesis suggests that cross-cultural variation in clothing richness and complexity is impacted by population size such that larger and denser populations tend to have more complex items of clothing and wardrobes (Henrich 2004; Kline and Boyd 2010; von Rueden and Jaeggi 2016). The presence of more expert artisans—tailors, weavers, various clothes-makers, etc.—in a society may lead to an abundance of expertise being taught and learned in larger societies as compared to smaller ones. Simply put, the more people there are in a society, the more experts will be produced, and the more expert knowledge can be disseminated. Such innovations would have greater impacts in larger populations than smaller ones, thus creating a possible feedback loop between innovation and population growth in terms of a population's technological complexity (Shennan 2001).

The present thesis is structured as follows. In the next chapter, I provide some background information for the study. Specifically, I discuss the available biological and archaeological evidence pertaining to the evolution of hominin clothing use. I also review sociological and anthropological literature regarding the use of clothing by recent humans. In the third chapter, I discuss Oswalt's method of classifying material culture in more detail and outline my ethnographic sample. In the fourth chapter, I discuss the hypotheses that I tested in the study and provide details of the analyses I used to test the predictions of the hypotheses. In the fifth chapter, I outline the results of my analyses. In the sixth chapter, I discuss the limitations and implications of my results, along with some potential future directions for research on this topic. In the final chapter of the thesis, I outline the conclusions I have drawn from the study.

Chapter 2.

Background

This chapter has several parts. In the first, I outline the functions of modern and traditional clothing, beginning with protection from the environment and ending with social signaling. Then, I discuss the prehistory of clothing, beginning with the archaeological evidence for early clothing, and continuing into biological evidence for human clothing. I end that section discussing the importance of clothing to hominin evolution.

2.1. The functions of clothing

Clothing confers many advantages upon its wearers. The most obvious of those advantages are related to protection from environmental hazards. The other set of advantages—social ones—are more complex. Some of those advantages are related to protection from injury and death in warfare, but many are related to social signalling and status-building. Decorative clothing, in particular, allows its wearers to non-verbally display fertility, wealth, and power.

2.1.1. Protection against the environment

It is obvious that thermoregulation is one of the most important functions of clothing. Clothing designed to aid in thermoregulation must balance the different but sometimes overlapping priorities of its wearers. In some circumstances, warm air must be trapped close to the body. In others, warm air must be allowed to dissipate. In still others, sweat must be allowed to escape close proximity with the skin. Thus, clothing must, in different circumstances, balance insulation and permeability. Both of these facets of clothing design are ultimately associated with maintaining thermal homeostasis.

Maintaining thermal homeostasis is essential for human life in any environment, but is particularly pressing in ones with relatively high or low ambient temperatures. Several heat- and cold-related pathologies exist, but while a human can die or experience pathologies caused by sustained exposure to heat, solar radiation, and cold—whether ambient cold, moisture-mediated core body temperature reductions, or wind chill—more immediate pathologies are notable. For example, an individual who overheats can experience nausea, malaise, and central nervous system dysfunction before hyperthermia proper sets in (Glazer 2005). An individual whose core body temperature drops and experiences restricted blood flow to their extremities can suffer immediate and drastic reductions in dexterity and mental acuity before hypothermia or frostbite set in (Parsons 2002). To mitigate such deleterious effects, garments must not only insulate their wearers, but be comfortable while doing so, since perceived discomfort itself causes reductions in mental acuity and performance (Bell et al. 2005).

The maintenance of thermal homeostasis is important both for preventing systemic pathologies such as hypothermia and for preventing more localised ones such as frostbite. Hypothermia is essentially the unsustainable drop in one's core body temperature. Frostbite is the burn-like damage that can occur on certain areas of the body exposed to extreme cold. Extremities such as fingers, hands, and toes are particularly vulnerable to frostbite. Such areas are vulnerable due to their low volume of blood flow and tendency toward vasoconstriction—a physiological reaction meant to be protective of whole-body heat loss, and one that is particularly common in humans with certain vascular pathologies such as the Raynaud's phenomenon (Ervasti et al. 2004).

For people in societies with access to modern heating and synthetic clothes, death by sustained exposure to the cold—hypothermia—is typically not a common risk factor, save for certain vulnerable groups such as the elderly, homeless, or mentally ill (Hanania and Zimmerman 1999). However, human core body temperature needs to be maintained within a relatively narrow range of 36.4°C to 37.5°C (Hanania and Zimmerman 1999). A core body temperature below 35°C is hypothermic. The loss of core body temperature is usually due to heat dissipation via the skin (Hanania and Zimmerman 1999). Humans can acclimate to moderate cold (down to -4ºC) while naked in spite of skin's heat dissipation mechanisms (Bodey 1978; Gilligan 2007), but hypothermia, particularly in wet and windy conditions, which accelerate heat loss, is a severe threat to inadequately dressed or acclimated humans (Parsons 2002). Hypothermic death typically occurs within six hours of nude exposure to an air temperature of -10ºC (Dettmeyer et al. 2014).

The kinds of external temperatures associated with severe risks of hypothermia are ubiquitous in only few inhabited parts of the world but are intermittently present in many others. Living or visiting Earth's polar regions entails the use of complex, layered clothing much of the time. As will be discussed later, the Eskimo-Aleut speaking peoples of the North American and Russian polar regions are notable for having highly complex skin garments designed to allow them to cope with temperatures that are often frigid. Garments of similar designs are present in the Russian polar regions and Greenland, and bear some similarities to the winter garments of North American Indigenous peoples down to around 60° N latitude. Researchers and explorers working in the Arctic and Antarctic often wear garments of broadly similar design (albeit made of very different materials) to those of small-scale societies of the Arctic, in an effort to prevent heat loss. The available data indicate comparable performance between the traditional Inuit parkas and high-end commercial cold weather clothing, and worse performance by standard-issue Canadian army winter uniforms compared to traditional Inuit parkas (Hill et al. 2020). The traditional caribou skin parka was especially notable for the strong performance of its fur-lined hood, and likely improved performance via a lack of vulnerabilities such as zippers (Hill et al. 2020). Evidence indicates that fur-lined hoods of traditional Inuit parkas tend to outperform modern mass-produced hoods in terms of their ability to transfer and maintain heat close to the wearer's face, therefore staving off heat loss (Cotel et al. 2004). When it comes to Inuit fur-trimmed hoods, bigger is better. So-called sunburst hoods, the largest hood designs present in some Inuit-speaking peoples' wardrobes (Oakes 1991), are particularly effective at promoting advantageous heat transfer.

Though the human body is not without internal mechanisms for maintaining thermal homeostasis, clothing of various designs functions as an envelope around the skin, mitigating some of the risks of being in a cold environment. Clothing's insulation properties are achieved, in part, by acting as a barrier to the escape of air warmed by the body (Havenith 1999). Under most circumstances, the volume of air trapped between clothing and skin is greater than the volume of the clothing itself. Therefore, the insulation potential of clothing scales directly with its thickness, whether that thickness is a property of one garment or many layered ones.

The use of multiple clothing layers to protect from the cold involves a trade-off in that the addition of an extra layer of clothing increases metabolic cost by approximately 4% (Parsons 2002). Therefore, keeping warm in very cold environments is not a simple matter of adding as much clothing as possible, assuming a limited resource base. The metabolic cost of clothing is also important with regard to human movement in cold environments. Movement, brisk or otherwise, brings about the problem of sweating. Sweat may be trapped between layers of clothing or between clothing and skin. Since contact with water facilitates heat loss from the skin, in a warm environment, the need for some degree of garment permeability is evident: if sweat and warm air are not allowed to escape, the immediate risk of hyperthermia increases, as does the medium-term risk of hypothermia. However, in cold environments, permeability can be more troublesome, and if moisture is allowed to evaporate in such environments, body heat loss will occur. If sweat is not allowed to escape, hypothermia is a risk with certain types of (particularly modern) garments, especially during periods of inactivity (Young et al. 2000).

Pre-hyperthermic overheating causes humans to sweat. Sweat represents an existential threat to humans living in the Arctic, although problems with moisture buildup are associated with rain as well. The buildup of excess moisture, whether external (rain or humidity) or internal (sweat) in origin is thought to be the greatest inhibitor of comfort and performance in cold weather (Jussila et al. 2010). While mitigating the dangers of excess sweating involves the use of permeable garments, the dangers posed by moisture from external sources such as rain require that people employ some degree of waterproofing in specialised cold-weather clothing. Many such examples exist in the ethnographic record of high-latitude peoples. Waterproofed clothing can entail the use of specialised materials such as sealskins or bear-gut not commonly used for non-waterproofed garments. Examples of specialised materials for waterproofed clothing include the gloves and boots of the Copper Inuit (Jenness 1946). On the other hand, the Koryaks of the Russian Far East (Jochelson 1908), and Deg Xit’an (Ingalik) of Alaska (Osgood 1940) make both waterproofed and non-waterproofed clothing of the same types of base materials (skins). Outside the Arctic, societies such as the Maori employed specialised rain jackets and capes that were designed to deflect the rain away from the body, and were often made of plant fibers such as flax (Hiroa 1949). The deflection of rain away from the body prevents the lowering of core body temperature. Whether they are made in the polar regions or much further south, waterproofed garments all serve the function of preventing moisture from lowering their wearers’ core body temperatures. Nonetheless, the base materials for waterproofed garments vary widely between cultures—even those living in broadly similar environments.

The majority of the environmentally-focused aspects of the study reported here involve humans protecting themselves from the cold since protecting oneself from ambient heat typically is achieved by wearing as little as possible. Though some modern protective clothing is specifically designed to mitigate overheating in circumstances in which undressing is not feasible, overheating can also occur to an over-insulated human. Hyperthermia's immediate effects have deleterious effects on cognition in addition to causing a cascade of metabolic effects resulting in increased fatigue (Duggan 1988; Fine and Kobrick 1985). Even in modern, non-specialised textile clothing both hypothermia and hyperthermia are recognised as important hazards that designers and manufacturers work to prevent (Laing and Sleivert 2002).

Frostbite is also an important factor in clothing designed to protect from adverse environmental conditions. Frostbite is a hazard caused by localised heat loss. Its mechanisms of action are twofold: direct cellular damage and progressive dermal ischemia. Direct cellular damage is caused by the formation of ice crystals in body tissues, which leads to their dehydration (et al. 2000). Dermal ischemia is a more complex process, though it is best conceived of as being comparable to a thermal burn. Essentially, direct cellular damage leads to a cascade of immune effects leading to edema and the arrest of blood flow to the affected regions (Murphy et al. 2000). While hypothermia can kill, frostbite has a tendency more often to maim. And while hypothermia typically requires hours of exposure to the cold, a pathology-inducing skin temperature of -4ºC (Cotel et al. 2004) is achievable within 30 minutes of exposure at air temperature of -20ºC, assuming a wind speed of 45km/hr and a consequent wind chill of -42ºC (Osczevski 1995). Like hypothermia, frostbite is particularly problematic in conditions that are cold as well as wet or windy (Parsons 2002).

Unlike hypothermia, whose prevention essentially requires sealing off from the environment as much of the human body as possible, there are specific design features of garments meant to protect parts of the body that are particularly vulnerable to frostbite. The addition of fur trim (often mustelid or canid) to gloves, boots, and other areas reduces the possibility of heat loss from vulnerable and exposed body parts via the creation of a boundary layer of air (Cotel et al. 2004). This layer aids in preventing heat loss both locally (for the prevention of frostbite) and systemically (for the prevention of hypothermia). The aforementioned Inuit sunburst parka is an example of a multifunctional garment whose hood design creates warm vortices of air on the face. It both prevents whole body heat-loss and maintains blood flow to the nose, ears, and lips, all of which are vulnerable to frostbite (Cotel et al. 2004). The designs of hoods and other fur-trimmed garments are broadly similar in many circumpolar peoples, though some groups line their garments on the inside rather than the outside, with the same protective effect (Cotel et al. 2004). The adoption of frostbite-prevention mechanisms on garments was not universal, however. For example, the Copper Inuit near the turn of the 20th Century are notable for having left their faces and wrists vulnerable to frostbite (Jenness 1946). The non-universal adoption may simply suggest a difference in the scale of risk factors for frostbite and hypothermia depending on specific environmental conditions.

Although the prevention of both hypothermia and frostbite primarily comes down to keeping warm, there are certain design elements that differentiate types of clothing meant to prevent the two phenomena. Rain jackets and capes, and to a lesser extent specialised waterproof boots and gloves, are examples of garments used specifically to prevent the buildup of water next to the skin, which can undermine thermal homeostasis. Garments such as Inuit parkas, while incorporating certain frostbite-prevention elements, are primarily designed to trap warm air within layers and close to the skin, therefore preventing heat loss. The use of fur ruffs and trim, while preventing whole-body heat loss, are likely primarily means of preventing frostbite because of the particular types of pathologies that tend to develop on wearers of garments lacking fur trim on cold-weather clothing (Jenness 1946).

Certain design features of garments are meant to mitigate pathologies not immediately caused by thermoregulatory dysfunction. For example, an overabundance of localised sunlight (UV radiation) can cause soft tissue pathologies independent of overheating per se. Pathologies such as sun blindness and sunburn are threatening enough that certain aspects of traditional clothing are designed specifically for their prevention. Sunburn is defined as a series of interrelated inflammatory reactions to UV-derived radiation burns (Whiteman and Green 1994). There are few specific design elements that aid in sunburn prevention, though the wearing of long and light-coloured clothing are notable strategies used to prevent it (CDC 2012). Snow blindness, a form of conjunctivitis and keratitis of the eyes, is essentially a sunburn of the eyes (Guly 2012). Its prevention is usually achieved through specific designs of accessories. There are several designs of snow goggles used to prevent that condition—some modern and some traditional. While modern designs employ tinted glass to block UV radiation, traditional examples such as those widely used by Inuit groups of the Polar region achieve protection by other means. Often made of wood, the Inuit goggles offer protection via the use of two small, horizontal slits. These decrease the amount of light hitting the eyes by around 90% (Norn 1996).

2.1.2. Social signalling

Humans also use garments to convey socially-relevant information. Conveying such information can happen with even plain garments intended primarily for thermal protection because a simple lack of decoration can convey specific social information. However, the process is particularly clear with purpose-made decorative garments. Most, if not all, societies use garments to transmit socially-relevant information, but the frequency with which it is done and its purposes are highly variable.

The study of clothing as a means of self-expression is not a unified field (Crane and Bovone 2006). There is considerable disagreement about the best framework within which to understand the symbolic value of clothing. This disagreement is largely due to the fact that scholars of the field come from numerous disciplines (Crane and Bovone 2006).

Clothing can be understood as a type of visual text, which is essentially a canvas onto which members of society, or subcultures within it, can project their values or visually express group membership (Jacobs and Spillman 2005). For example, group affiliations can be displayed via the use of certain colours or designs specific to cultures or groups of people within cultures. Other information, such as prowess in battle, can be communicated with certain garment types or features of garments. For example, a war bonnet signifies not only the wearer’s status as a warrior, but potentially also his people’s current state as being at war.

Alternatively, the decorative aspects of clothing can be understood as a gestalt manifestation of the skills and tastes of expert craftsmen and designers from diverse, but typically advanced and highly commodified, backgrounds (Entwistle 2002; Goldman and Papson 1998). This sort of aesthetic economy—i.e. the means by which fashion trends spread throughout society—conceives of the decorative aspects of clothing, at least in

Western societies and the ones that emulate them, as being utilitarian in the sense of their dissemination being driven largely by the goal of upholding consumerism. Widespread consumption of specific decorative choices is achieved via the promotion of specific, profitable aesthetics, while designers maintain reactivity to the demands of the market, thus at once setting fashion trends and capitalising upon them (Gereffi 1994).

Some clothing can also be understood as a form of propaganda. This sort of propaganda could potentially be used by those in power—embroidered hammers and sickles or National Socialist armbands—but clothing can also be propagandised to amplify the potentially subversive values of a particular manufacturer or subculture. While Entwistle (2002) presents a reactive, and perhaps somewhat passive view of fashion and decorations' dissemination of information, other researchers disagree with a passive view of clothing design. Designers and sellers of decorative clothing can instead be understood as taking an active role in creating what is perceived by the public as a desirable aesthetic, irrespective of whether that aesthetic is healthy or congruent with other values a society may express or uphold (Goffman 1976). Thus, the industries disseminating this form of visual propaganda make orthodox what may have previously been subversive (Crane 2012).

Clothing's decorative aspects can work to express information at either the individual or the group level. That information—termed 'values' in (Crane and Bovone 2006)—should not be regarded as completely discrete categories, however. Individual values can inform group ones and vice-versa (Crane and Bovone 2006). Nonetheless, the dichotomy between individual and group value signalling is useful shorthand to understand clothing's multifaceted role in social signalling.

Much group signaling relates to conformity, and this is reflected in choice of clothing. Clothing choices—even subtle ones below the level of uniforms—are readily detectible by outsiders as signals of group affiliation in modern societies (Chan et al. 2012). Group affiliation signalling can also coincide with signalling one's uniqueness (Chan et al. 2012). Thus, in modern societies at least, aspects of one's clothes can be a vehicle to signal both conformity and uniqueness—the former often related to group affiliation and the latter more often as an affront to certain affiliations (and perhaps the implicit association with another group: non-conformists).

Clothing allows groups to delineate tribal identities, irrespective of those identities' stability or impermanence—oftentimes the identities are ill-defined (Goffman 1961). However, decorative clothing also allows humans to subvert or blur tribal, political, and class affiliations (Thornton 1996). A modern example for both situations is the use of t-shirts displaying the logos of favoured bands. A band may simultaneously be popular (creating a group affiliation for the shirt's wearer), trendy (relevant temporarily), and subversive (alternative music perhaps popular only within a certain age group). The subversion of group identities—in the former example, potentially a middle-class office worker—likely creates other, possibly more diffuse ones—such as middle class office worker who attends late-night rave parties. Furthermore, it is notable that in industrial societies such expressions of a person's supposed rebelliousness are often purchased from large retailers. Decorative clothing, under the aforementioned paradigm, can, depending on context, create or subvert group identities or act, at least consciously, as a means of self-expression, even if that expression is identical to the self-expression of many other people.

The goals of signalling conformity and uniqueness are easily achievable in modern societies through a range of choices in clothing styles. Although consumer choice in clothing carries with it some degree of arbitrariness, different brands of clothing tend to shape others' perceptions of the brands' wearers. Furthermore, although the perceptions of specific brands of clothing tend to be stable, those perceptions are attached to the brands, and are reflective of the views and feelings of viewers of them, but are not necessarily reflective of the deep-lying and more stable personality traits of their wearers (Feinberg et al. 1992). Whether or not the disparity between wearers' social personalities and their attitudes toward particular types of decorative clothing holds for people in small-scale societies is unclear. Such a study in small-scale societies may be possible assuming that traditional decorative clothing and modern branded clothing are analogous, and some recent research documents a syncretic aspect to the use of common and prestige clothing in small-scale societies that may be fruitful for future study (Mosko 2007). Unfortunately, such a study has not yet been carried out.

As previously mentioned, certain types of garments can convey individual wearer's personalities and affiliations—however unstable they may be—, but clothing also has the power to uphold the values of societies as wholes. When the concept of 'decorativity' (e.g. the degree to which a garment—by percentage of decorative components—is devoted to conveying social information) is expanded to include more direct body modification, it is clear that under certain circumstances, types of decorative clothing are associated with particular types of political organisation (Steiner 1990). In traditional societies, many employ prestige clothing specifically for use during exclusive ceremonies or by secret societies—masks on the Pacific Northwest Coast of North America for example. In modern societies, people may display their religious or political affiliations on garb purpose-made for that display—hijabs or shirts promoting political candidates, for example. Therefore, decorative aspects of clothing and accessories have long histories in human societies and are tied fundamentally to our ability to signal group values. Furthermore, as will be discussed later, decorative aspects of garments seem to be associated with certain foundational aspects of human societies such as political organisation, marriage typology, demographics, and perhaps certain physical attributes as well.

Societies have very different views on the acceptability and inevitability of conflict, along with variable views about the correct means of the affected parties dealing with conflict when it does arise (Bonta 1996). Small-scale societies generally employ strategies of dress that can either be considered physically protective (such as armour) or conflict-reducing via mechanisms such as threats and intimidation, which play a larger role in violent encounters than is often appreciated (Pardoe et al. 2014). Many ethnographically-documented societies around the world employ ostentatious prestige garments, often related to war or evoking warlike imagery (Hiroa 1949; Kaufmann 1910; Murie 1989). Such garments' ostentatiousness may act as a means of conflict-reduction in the context of wearing such garments for the eyes of outsiders. Prestige garments showing wealth likely operate in a similar manner, reducing the chances of conflict and violence via intimidation before the violence has even started.

Particularly ostentatious examples of both men's and women's clothing, whether ceremonial in the case of wedding garments, or more common prestige garments such as those that are worn by high-ranking members of many traditional societies, can be seen as enforcing pre-existing hierarchies (group signalling) while still signaling individual values such as wealth and attractiveness. By their very nature, prestige garments are restricted, and are some combination of rare, rarely worn, and worn by particular members of society only. Examples of the multifaceted role that prestige garments play abound in the ethnographic record. The Pueblo cultures of the American southwest are particularly notable for the preservation of their men's prestige garments, which have been interpreted as means of enforcing status, hierarchies, and signalling personal and household glory (Mills 2004).

The use of clothing as a vehicle for decorative symbolism is particularly important in industrial societies, especially ones with sharp class differences (Crane and Bovone 2006). As will be discussed in detail later, many small-scale societies invest time and energy in the symbolic aspects of clothing and other decorations, so the desire to use decoration to convey information is ubiquitous in human societies, whether industrialised or small-scale. The current preoccupation that industrialised societies have with mass consumerism and production of symbolic, decorative clothing may have more to do with the blurry distinctions between different status brackets in those societies compared to those of small-scale societies. Hierarchies in industrial societies may have deeper roots than those in smaller-scale ones, but they may be relatively ill-defined. Simply put, in smaller populations, it is more difficult for one to be anonymous, and thus there is likely a greater *a priori* knowledge of the status of one's contemporaries. If this is true, we should expect that the use of decoration and symbolism in or on clothing in small-scale societies ought to serve more restricted and well-defined purposes than do the decorations on clothing in larger-scale ones.

The potential dichotomy between clothing's more well-defined signalling ability in small-scale societies and the more fluid state of signalling in modern industrial ones is not necessarily reflective of centuries past in now-industrialised areas. While the appropriateness of wearing a particular garment and telegraphing a particular signal are context-dependent in the modern day, there were more rigid conventions in previous times. For example, particular types of silks and furs were limited to specific classes in 14^{th} and 15^{th} Century England and the Italian city-states (Phillips 2007). The general upheaval in the years after the Black Death may have been a contributing factor to the efforts made by nobles to create highly visual boundaries between themselves and commoners at the time, and by the higher nobility to create boundaries between themselves and mere gentlemen. However, a similar situation with regard to restrictions on certain garments is evident in 17^{th} Century Japan (Shively 1964), suggesting that sumptuary regulations are far from being only European in origin, and that such rules have been used for centuries throughout the world. The current state of fluidity regarding rules, roles, regulations, and social signalling are not a particularly Western (or

Japanese) innovation, but they certainly seem to deviate from the normal state of things in both small-scale societies and in the recent past of larger-scale ones.

An aspect of the signalling ability of clothing (in this report, inclusive of jewelry, paint, oils, etc.) that should be understood primarily as individual signalling and only secondarily as group signalling is sexual signalling. Sumptuary regulations, as discussed previously, should be regarded as group signalling masquerading as individual signalling, especially with regard to classes of people whose choices of clothing were rarely fully their own—for example, prostitutes in Renaissance Italy (Brundage 1987). Sexual displays can be achieved through bright colouration, specific fits, garments that require large investments of time and energy to make, or components of clothing that are rare and precious. Wedding clothing is an obvious form that embodies some of those factors, and some degree of special wedding clothing, especially for brides, is present in many societies. In Western societies, wedding garments, especially those belonging to the bride, are notably expensive relative to everyday garments. In traditional societies such as the Manus of Papua New Guinea, wedding garments are not especially expensive--in contrast to the reality in many industrialised societies—but are worn very particularly during the wedding and adjacent ceremonies (Mead 1930). The use of bright, vibrant colours—particularly with the use of flowers—in many traditional sets of wedding garb likely signal vibrance, fertility, and therefore youth. That imagery is different—though echoed, in signaling effect—in Western societies, whose brides often use the colour white to symbolise virginity, and therefore presumed youth and fertility. The wedding dress' power as a signal of youth and fertility is the obvious primary goal of the garment, though a wedding—as an event—secondarily signals group/familial affiliation and the transfer of wealth from group to group.

Certain garments offer a blunter sort of imagery, and likely function purely on the level of individual signalling. For example, ochre's widespread ethnographic and ancient use as a paint applied to the skin or to garments themselves is largely thought to symbolise blood and thus fertility and life (Meyer 2014; Wreschner et al. 1980). Ochre in some contexts likely symbolises fertility and health—and in others, war and power (Wreschner et al. 1980). And given its ubiquity in human societies, ochre is probably a near-universally understood individual sexual signal, at least in the context of decorations on items not useful for committing violence. However, given the fact that ochre produced one of the only bright pigments available to Pleistocene hominins, its symbolic significance may be overstated.

Men's clothing, especially that of non-highly ranked men, is widely and highly competitively used, both in terms of war and in terms of sex, in traditional societies. Men's clothing may at times be designed to impress women (Wallace 1986), though much of it ought to be regarded as a means to intimidate other men, particularly those outside of their own groups. Examples of ritual intimidation clothing include the purpose-made war dance garments of the Maori haka (Matthews 2004; Papesch 2015). Though notably, the haka and its associated garb need not signal violent intentions and can instead be involved in nonviolent ceremonial dance or as a means of achieving catharsis (Matthews 2004). Certain garments, therefore, are capable of signalling different information in different contexts.

2.2. The prehistory of clothing use

Clothing is unique to the hominin lineage. It has no satisfactory analogues in nonhuman animals except for faint echoes such as orangutan leaf 'hats' for protection from heavy rainfall (Meulman and van Schaik 2013). This means that we can be confident that the use of clothing arose in our lineage after the split between our ancestors and the ancestors of chimpanzees and bonobo around 6,000,000BP to 8,000,000BP (Langergraber et al. 2012), but to narrow down the time frame further we must turn to archaeological and biological evidence.

2.2.1. Direct archaeological evidence of early clothing use

The preservation of items of non-jewelry clothing is limited to the last few thousand years. This is because traditional clothing is largely made of plant fibers and/or animal skins and is therefore biodegradable. It is also because traditional clothing is often delicate and consequently prone to damage. And though some isolated scraps of plant fiber from the Eurasian Upper Palaeolithic may be indicative of early clothing use (Conard and Rots 2016; Leroi-Gourhan 1982; Nadel et al. 1994), true evidence for woven cloth are much more recent. The earliest surviving examples of woven cloth date to the early Holocene of the Levant and Anatolia at sites such as Çayönü and Nahal Hemar (Schick 1988; Shimony and Jucha 1988; Wilford 1993). Ötzi the Iceman, dated to around 5,300BP and found in Tyrol, Europe, died wearing a cloak, a coat, a belt, a pair of leggings—differentiated from pants on the basis that leggings are attached to a belt, whereas pants are integrated leg and seat pieces—and a hat made from animal skins and plant material (Püntener and Moss 2010). While beads are direct evidence for the use of garments, the oldest preserved woven garment is the Egyptian Tarkhan dress. Dated to around 5,100BP, the Tarkhan dress is made of flax fibers (Stevenson and Michel 2016). The earliest skirt dates to around 3,500BP and was found in the Egtved burial in Denmark (Bergerbrant 2014). The earliest pants are from Turfan, China. They date to around 3,200BP and are made of wool (Beck et al. 2014).

While ‘garment’ is often defined as items such as those discussed in the previous paragraph, my definition of the term is inclusive of jewelry. Items such as necklaces, leglets, etc. are not often preserved in their entirety; however, their hard parts—beads, for example—preserve remarkably well, and many examples predate the aforementioned soft garments by many millennia. The remainder of this section will focus on the well-preserved hard components of garments such as beads. Such evidence forms some of the strongest examples both of early clothing use and of early symbolic behaviour by hominins. And while the majority of that evidence is made by our species—*H. sapiens*—some of it was produced by Neanderthals. One of the earliest examples of clothing found anywhere is the polished, notched eagle talons associated with Neanderthal habitation were found at Krapina, Croatia and date to approximately 130,000BP (Radovčić et al. 2015). Finds of perforated and painted *Pecten* shells from *Cueva de los Aviones* and *Cueva Antón* in Spain dated to ca. 115,000BP (Hoffmann et al. 2018) and to ca. 50,000BP (Zilhão et al. 2010). Purposefully-removed avian feathers from *Grotta di Fumane* in Italy dated to around 44,000BP (Peresani et al. 2011) and an ochered gastropod shell from Fumane Cave, Italy from around the same time (Peresani et al. 2013) are additionally suggestive the use of clothing by Neanderthals.

Turning now to *H. sapiens* proper (to the exclusion of the Neanderthals), several sites in southern Africa including Blombos cave (Jacobs et al. 2006) have yielded ostrich eggshell beads that date to 90-100,000BP as well (d’Errico et al. 2008). Marine shell beads dated to between 90-100,000BP are documented from Oued Djebbana in Algeria (Gilligan 2010a; Vanhaeren et al. 2006). Many shell beads are recorded from Grotte des Pigeons cave in Morocco and are dated to ca. 80,000BP (Bouzouggar et al. 2007). The Moroccan beads are stained with ochre and are associated with side scrapers, which I will later discuss as possible indirect evidence for hide-working (Gilligan 2010a). Panga ya Saidi, Kenya, yielded ostrich eggshell beads dated to ca. 78,000BP (Shipton et al. 2018).

Southwest Eurasia yields clothing evidence for *H. sapiens* jewelry that is nearly-contemporary with the African examples. Possible contenders for the oldest bead ornaments may date to between 90-100,000BP, and have been found at Skhul in Israel (Gilligan 2010a; Vanhaeren et al. 2006). Jewelry made a more recent appearance in Europe and Anatolia. The oldest recorded beads in Eurasia, excluding the aforementioned material from Sri Lanka, were found in pre-Aurignacian levels of Bacho Kiro cave in Bulgaria, and are dated to more than 43,000BP (Kuhn et al. 2001). Specifically, the items are pierced animal teeth perhaps used on a necklace or otherwise as pendants. Slightly postdating the Bulgarian material are beads from Uçağızlı Cave in Turkey. The Uçağızlı Cave material is dated to ca. 41,000BP and consists of perforated gastropod and bivalve shells (Kuhn et al. 2001). The Uçağızlı Cave material is notable for offering a strong comparative sample: the cave yielded examples of mollusc shells clearly used only for decoration and others, far more smashed and otherwise processed, clearly used for consumption (Kuhn et al. 2001). The differential use of molluscs by the inhabitants of the cave indicates very specific, non-incidental intentional manufacture of ornamental items *en masse*.

Sites such as Bacho Kiro cave and Uçağızlı Cave, either pre-Aurignacian or coincidental with the beginning of Aurignacian industries respectively, contrast sharply with the picture of the human use of beads and beadlike objects in the Aurignacian proper. There are examples of such items from more than 98 sites sorted into 157 types from Iberia in the west to Russia in the east (Vanhaeren and d'Errico 2006). The use of beads and beadlike objects was common in the Aurignacian, but beads become particularly ostentatious in certain sites associated with the Gravettian industry.

Central Asia yields several examples of decorative clothing use of great antiquity. Shell beads (postulated to be bracelets and necklaces) and pendants dated to between 40,000BP and 26,000BP are recorded from several Siberian or Altai Mountain sites such as Denisova Cave (Derevianko 2001; Derevianko et al. 2008) and Podzvonkaya (Tashak and Kradin 2002). Finds in Central Asia are not limited to shell beads. Decorated (incised, in this case) bone tubes are recorded from Denisova Cave and

Kamenka, both dated to between 40,000BP and 35,000BP (Kuzmin et al. 2011). Further east and roughly contemporaneous with the Siberian material, the site of Kara Bom in Mongolia yields bone pendants (Gladyshev et al. 2013).

Beads and beadlike objects may often have been used in the form of necklaces, bracelets, and similar accessories, though there is strong evidence for their incorporation into garments, particularly at Gravettian sites. Finds from Sungir in Russia, dated to ca. 30,000BP (Pettitt and Bader 2000), illustrate this. In one burial, thousands of mammoth ivory beads appear to have been attached to a man's jacket and other garments (Bader and Bader 2000). The sheer number of beads is perhaps suggestive of the special status of their wearer, though that is not certain. Sungir is not the only Gravettian burial illustrating the use of decorative garments. The skeleton known as Il Principe from Arene Candide, Italy, and dated to ca. 24,000BP was clearly buried with a cap to which were attached hundreds of perforated seashells and deer canines (Pettitt et al. 2003). Furthermore, the burial included several mammoth ivory pendants (Pettitt et al. 2003). Finds such as the Sungir burials and Il Principe emphasise the importance of decoration in Gravettian burials, and that importance, given the evidence, was likely a culmination of millennia of increasing emphasis on decoration-associated clothing components across Eurasia and Africa.

The Indian Subcontinent has evidence for early clothing use. In fact, the earliest evidence for the use of clothing (in this case, beads made of ochered marine shells) by *H. sapiens* proper anywhere outside of western Eurasia and Africa is from Sri Lanka, and that evidence is dated to around 48,000BP (Langley et al. 2020). The site of Batadombalena Cave in Sri Lanka yields additional shell beads dating to between 35,000BP and 30,000BP (Mellars et al. 2013). Further north on the Subcontinent, shell beads are known from Patne, India, and are dated to 30,000BP (Sali 1989).

The earliest direct evidence for clothing in East Asia comes from the burials in the Upper Cave at Zhoukoudian. Hundreds of pierced animal teeth, sea shells, and pebbles are among the finds (Wymer 1982). The finds are ascribed alternatively to either the 'Latest Pleistocene' (Boaz et al. 2004) or the East Asian Late Palaeolithic (Norton and Gao 2008). The white calcareous beads are covered in red hematite, are thought to have been used in necklaces, and are directly associated with burials (Norton and Gao 2008). In addition, four bone pendants were found, though their exact stratigraphic context is unknown, thus hampering dating efforts (Norton and Gao 2008). While the Zhoukoudian finds are numerous and bear similarities with decorations found at Kostenki far to the west (Wymer 1982), well-dated finds from East Asia are rare. However, one example is suggestive of decorative industries much like western Eurasian ones, and roughly contemporary with them. Shuidonggou yielded several ostrich eggshell beads, although direct dating has only been performed on a presumably older incised valve of the mollusc *Corbicula fluminea* (Wei et al. 2016). The shell is dated to at least 34,000BP. While the East Asian evidence is poorly-dated, the known dates and contexts in which finds have been discovered suggest the presence of decorative behaviour dating back well into the Upper Pleistocene. In addition to the evidence from continental East Asia, Golo Cave on Gebe Island in eastern Indonesia has evidence of longstanding shell bead production from as early as 32,000BP through the end of the Pleistocene (Szabó et al. 2007). Less certainly dated is a tiger shark tooth, likely perforated for use as a pendant, from between 39,500BP and 28,000BP, and found on New Ireland, New Guinea (Leavesley 2007).

Turning to Australia, it is notable that clothing is often sparse among many Australian Aboriginal groups, modern and ones living in more traditional ways around the time of European contact (Gilligan 2010a). Clothing was certainly present among Australian Aboriginals by the time of the Last Glacial Maximum (LGM) (Gilligan 2010a), but direct evidence is scarce. The earliest piece of evidence in the form of *Conus* shell beads from ca. 32,000BP was found at the site of Mandu Mandu in Western Australia (Morse 1993). Slightly later (ca. 32,000BP) shell beads are known from Riwi in the Kimberley of Western Australia (Balme and Morse 2006). One grave from Roonka Flat in southeastern Australia is dated to around 10,000BP, and includes an elaborate headband of animal skin and wallaby teeth (Hiscock 2007). That individual was also wearing a shroud. Many other burials from Roonka Flat include decorations and aspects of garments, perhaps in association with human sacrifice and funerary rituals (Hiscock 2007). Whether or not the Roonka Flats burials represent clothing worn during the individuals' lives is an open question, but the story of Aboriginal Australian clothing is one of relative nakedness.

With regard to evidence from the Americas, early evidence of clothing from the Americas is particularly notable for the presence of the earliest recorded footwear. A pair of sandals from Fort Rock Cave, Oregon dates to around 10,000BP (Connolly et al. 2017).

Evidence for the use of perforated shells, beads, and similar is roughly contemporaneous with or postdates the Fort Rock Cave Sandals. Such items are found in the American Southwest, Alabama, the Great Lakes region, and Louisiana (Dubin 1999). Such items remain the basis of rich industries of jewelry manufacture in areas such as the American Southwest (Medchill et al. 2020). The archaeological evidence from South America is sparse, but decoration in the form of platinum adornments were certainly incorporated into the ceremonial garb of elites in Peru and Ecuador by 3,000BP (Hesse 2007).

2.2.2. Indirect archaeological evidence of early clothing use

There are several lines of indirect evidence for clothing use in the distant past. The richness of the indirect evidence for clothing is particularly relevant to Palaeolithic clothing, for which little direct evidence has survived—particularly of softer garments. While some of the evidence—particularly from Eurasia—is certainly associated with clothing, some of the evidence is problematic.

With regard to the African evidence, much of the earliest evidence comes in the form of bone and stone tools. Lithic tools such as scrapers, blades, piercers, and Levallois flakes have been argued to be proxies for hide-working and therefore, most likely, clothing manufacture (Gilligan 2010a). Furthermore, there are temporal associations between the very cold Marine Isotope Stage 4 (d'Errico and Henshilwood 2007) and the proliferation of scraper and blade technology—as evidenced from sites such as Howiesons Poort at perhaps 55,000BP and the awls from Blombosch Sands dated to perhaps slightly later. Those artifacts—both lithic and bone—and many others are argued to be evidence of clothing manufacture by virtue of their status as proxies for hide-working (Gilligan 2010a).

Despite the argument for scrapers as proxies for hide-working and therefore perhaps clothing manufacture, that association bears caution. Lithics in general suffer from classification schemes that rely on strong categories that break down under analysis due both to the potential for lithic artifacts to function as both tools and portable tool-manufacturing materials, and for the categories of different end products to be blurry and subjective (Hiscock 2000). As a category, the term scraper does not follow common convention. It comprises two categories of lithics: sidescraper and endscraper. Side-scrapers as a category seem to be a wastebasket, with different classes of scraper bleeding into others. Furthermore, the category itself may simply be representative of other lithic types at different stages of their use-lives rather than a discrete category (Dibble 1987). In addition to the problems with scraper classification, there are questions about the typological affiliations of Levallois lithics (Dibble et al. 2017). What are called Levallois 'points' are poorly-differentiated from 'scrapers' of the same industry, and the two are primarily demarcated on the basis that the former "could kill a bear" (Dibble et al. 2017:818). Between the fuzzy definitions of scrapers, Levallois lithics, and others, and the relatively few types of lithic tools with solid associations with hide-processing and thus clothing manufacture, lithics are troublesome evidence. Therefore 'scraper' is, at best, a weak proxy for hide-working and clothes-making and requires extensive qualification to be of any use. Furthermore, 'side-scrapers' are a deeply flawed category of lithic.

Certain categories of lithics are clearly ill-defined in the literature. Fortunately, compared to the association between hide-working and 'scrapers' or 'side-scrapers', the association between hide processing and endscrapers is somewhat clearer from the archaeological (Bailey 1999; Keeley 1988a; Tomenchuk and Storck 1997), blood residue (Loy and Hardy 1992); ethnographic (Hayden 1986; Loebel 2013), and experimental evidence (Pyżewicz and Nerudová 2020; Schultz 1992). Nonetheless, despite the reasonable associations between endscrapers and hide-working, hide-working does not necessarily entail clothes-making and may instead indicate the manufacture of storage containers such as bags (Gilligan 2010a) or perhaps shelters and bedding. While endscrapers are likely a better indicator of hide-working and perhaps clothes-making than 'side-scrapers' (or ill-defined 'scrapers' are as an umbrella category) are, they are an insufficient proxy for hide-working and clothes-manufacture. That insufficiency is in spite of the likelihood that in at least some cases, endscrapers were used for exactly those purposes.

Bone tools such as awls and needles offer stronger evidence for clothes-making than do lithics in the sense that use-wear and ethnographic data associate them frequently with garment-making (Gilligan 2010a; Henshilwood et al. 2001). Bone awls are present in southern Africa around 80,000BP (d'Errico and Henshilwood 2007). Bone awls may simply have been used to make bags or bedding. Nonetheless, use-wear analyses of examples from Blombos cave suggest bags or clothes as equally likely objects of manufacture—indicating that bone awls may indicate at least some degree of clothes-making where they are found (Henshilwood et al. 2001). The abundance of bone technology such as awls in the tool industries Late Pleistocene South Africa waxes and wanes between ca. 84,000BP and ca. 30,000BP (Backwell et al. 2008; Gilligan 2010a). This waxing and waning coincides with climatic shifts: awls occur during colder times and disappear during warmer ones, though they only become common around 30,000BP, during the LGM (Gilligan 2010a).

Eyed needles are, in certain circumstances, preceded by non-eyed needles that are little different from the awls. While the later Upper Palaeolithic archaeological record of Eurasia is rich with eyed needles, the earliest human habitation of the continent circa 40,000BP is associated with bone awls and non-eyed needles (Gilligan 2010a). Awls and non-eyed needles are associated with Aurignacian toolkits (Anikovich et al. 2007), and with some difficulty, can be used to make clothing, though those garments would not have been as finely-made as if eyed needles were employed (Gilligan 2010a).

The proliferation of the eyed needle, associated with the Gravettian and Solutrean industries of the Upper Palaeolithic (de Sonneville-Bordes 1973; Hoffecker 2005; Semenov 1964), and the tool's subsequent spread across Eurasia during particularly cold climatic phases (Gilligan 2010a) are strongly suggestive of a direct link between garment manufacture and eyed needles. The progression from bone awls to non-eyed needles to eyed needles did not take place in that order or at the same times throughout the world. However, the rapid appearance of bone awls coincides with a particularly cold period in South Africa around 80,000BP at sites such as Blombos cave (Henshilwood et al. 2001); relatively frigid times circa 50,000BP to 40,000BP throughout Eurasia (Gilligan 2018), and during the LGM in Australia (Gilligan 2018). Furthermore, their appearance in North America coincides with the several-thousand-year cold snap known as the Younger Dryas (Hoffecker 2005; Lyman 2015). While the presence of bone tools that may have been used to make specialised cold-weather garments is not conclusive evidence for those garments—they are also used to make items such as nets (Gilligan 2010a)—their presence is suggestive of at least some clothes-making, especially at sites such as Sungir, which, at 30,000BP, would have been quite frigid.

While the bone evidence associated with clothes-manufacture is relatively abundant, there is far less soft, biodegradable evidence that survives. Wild flax fibers, perhaps associated with linen production, are known from Georgia and dated to around 30,000BP (Kvavadze et al. 2009). Possible evidence of the very earliest soft garments are from impressions on pottery fragments suggesting that weaving plant fibers may have been employed at the site of Pavlov I in the Czech Republic as early as 29,000BP, during the LGM. (Adovasio et al. 1996). Slightly later evidence of plant fibers from the site of Ohalo II in Israel is perhaps suggestive of clothes-making (Nadel et al. 1994). Thus, while needles and awls indicative of garment-making and coincident with particularly cold climates are the earliest possible evidence for garment-making in Eurasia, actual plant fibers are only recorded significantly later than the proliferation of those bone tools.

In addition to the hard and soft material culture associated with clothes-manufacture, the Eurasian archaeological record is full of compelling indirect evidence for clothing in the form of artistic depictions. A number of famous Venus figurines appear to depict garments. For example, the Venus figurine from Brassempouy, France which dates to 25,000BP, has been interpreted as wearing woven headgear (Gilligan 2010a; Soffer et al. 2000). Of particular note among the Venus figurines because it depicts a lower-body garment, is the Venus of Lespugue from France. Dating to 25,000BP and made of mammoth ivory, this figurine appears to depict a belt and a braided skirt hanging from it (Soffer et al. 2000). Figurines from Buret' and Mal'ta in Russia, dating to around 20,000BP, likely depict parkas or similar hooded garments (Collins 1986; McBurney 1976).

Artistic depictions of humans wearing clothing are not limited to figurines. The engraved La femme à anorak from the Upper Palaeolithic of France's Gabillou cave clearly depicts a person wearing a hooded parka (White 1986). Furthermore, several engravings from French Magdalenian sites including Angles-sur-l'Anglin and La Marche seem to depict clothing and hoods (de Sonneville-Bordes 1973; Gilligan 2010a; White 1986).

Footwear was likely necessary at times during the often-frigid European Upper Pleistocene. While early European contacts with Patagonian tribes such as the Yahgan (Lothrop 1928) underscore the human ability to acclimate to cold environments—perhaps to the exclusion of the use of footwear—the snow and ice of the LGM and the millennia before and after would have induced pathologies on exposed feet. While there are no examples of footwear from this time period, of particular note among the evidence we do have comes in the form of footprints. Footprints, likely made by feet encased in moccasins, are recorded at the French cave site of Fontanet (Baffier and Leroi-Gourhan 1988). However, our knowledge of footwear during the Upper Pleistocene is particularly poor, relative to our knowledge of other clothing.

Though we have an unclear picture of the use of footwear before the European Early Holocene, there is some morphological evidence for footwear use during that time. Given that many bones of the lower leg and foot—the phalanges, for example—respond to the mechanical stresses of being openly exposed to various substrates by increasing in robusticity or diverging from one another in consistent ways, it is possible to model the use of hominin footwear in the Middle and Upper Palaeolithic. When the anatomical adaptations to mechanical stresses on the feet are modelled, the pattern that emerges is one of decreased robusticity of the pedal phalanges, indicating an increasing, but inconsistent, use of soft-soled footwear between the Middle Palaeolithic and the Middle Upper Palaeolithic (Trinkaus 2005). These data suggest two conclusions: first, that the Middle Palaeolithic to Middle Upper Palaeolithic footwear shift was geared towards either protection from the substrate, from frostbite, or from both. As mentioned, though no direct evidence for footwear has been found predating the earliest Holocene, it certainly seems to have been necessary and was likely used in many environments, in spite of the prevalence of recorded bare footprints from many cave sites (Baffier and Leroi-Gourhan 1988). Second, increasing tendencies toward human adoption of harder-soled footwear may have had as much to do with cultural shifts in taste as it did increased levels of protection (Trinkaus 2005). The lack of direct evidence may have as much to do with the possibility that footprints made by people wearing soft footwear may be particularly amorphous and thus, unrecognisable in the archaeological record (Trinkaus et al. 2021).

Developments in the early clothing of East Asia mirror those in western Eurasia. There is evidence of blade industries from 40,000BP at Shuidonggou in northwest China (Gilligan 2018). Nonetheless, the problems with the association between certain lithic types and hide-working bear reminding here. Bone awls, certainly less equivocal evidence for hide-working and perhaps clothes-manufacture, date to 35,000BP at Ma'anshan cave in central eastern China (Gilligan 2018). Eyed needles date to 30,000BP and are found at Shuidonggou, and finely-made and frequently-found eyed needles date to between 30,000BP and 20,000BP at Xiaogushan cave, and to 26,000BP at Shizitan in modern

Shanxi Province (Gilligan 2018). While broadly contemporary with specialised bone tools in western Eurasia, it bears mentioning that the clothes likely made with such implements would have been required to exist in the areas between the Chinese sites and the western Eurasian ones. Indeed, the Denisova cave yields an eyed needle that likely predates 35,000BP (Gilligan 2018). Eyed needles as a whole were likely spread by and also enabled the spread of modern humans from Africa into all of Eurasia. The earliest evidence for clothes-making in Australia comes in the form of ‘scrapers’ and bone awls dated from various cave sites in the southeast to between 32,000BP and 22,000BP (Gilligan 2018). Use-wear analyses were not performed; however, those implements are very similar to ones used by modern Aboriginal Australians. Furthermore, many of the depictions of human figures by Aboriginal Australians, many pre-dating the LGM by millennia, depict clothing, body paint, and other garments (Hiscock 2007).

Much of the early material culture related to hide-working and potentially clothes-making associated with the peopling of the Americas is similar to evidence found in Siberia (Gilligan 2010a), though later evolutions in material culture proceeded in novel directions. Beringia yields eyed needles and perhaps needle cases from the Yana River, and suggest they were employed by 32,000BP (Hoffecker et al. 2016). Eyed needles are present in modern Alaska at the site of Broken Mammoth, and date to 13,000BP (Hoffecker 2005). Evidence suggests such eyed needles were ubiquitous and necessary for many Palaeoindian groups and were established as such by 13,000BP to 10,000BP—coinciding neatly with the frigid Younger Dryas (Lyman 2015). The archaeological evidence for clothes-making, however, predates the evidence for garments only slightly. As mentioned before, shoes were present in the Americas by 10,000BP. While the peopling of Central and South America happened relatively shortly after the expansion from Beringia into North America (Borrero 2016), hard evidence is scarce. The peopling of South America almost certainly included perishable technologies such as textiles (Adovasio and Dillehay 2020), but the current evidence is suggestive of a relative lack of need for such technologies compared to peoples further north. There are examples of pin-like and needle-like technologies from many Late Holocene sites in the Paraná wetlands of Argentina, but they date to only around 1,000BP (Buc and Loponte 2007). As discussed previously, early European explorers remarked on the ability of Patagonians to wear very little and yet thrive in their relatively cold environments. The balance of the evidence suggests that early South Americans likely did make (and need) clothing throughout much of their range, but it may have been more scarcely-used and less complex than clothing from North America and Eurasia. If that suggestion is true, then the hard (and soft) evidence will eventually be found for early South American garments or garment-making, but it was not very abundant in the first place.

While the archaeological record of clothing is limited by the biodegradability of animal skins and plant fibers, enough evidence exists to create a clear picture of hominin clothing use in the Upper Palaeolithic and later. The earliest Eurasian evidence for clothing—apparently jewelry made by Neanderthals—appears by 130,000BP. Jewelry made by *H. sapiens* is established in southwest Eurasia by 90,000BP, in Western Eurasia before 45,000BP, and on the Indian subcontinent by around 50,000BP. The earliest African evidence dates to around 100,000BP, and comes in the form of beads, likely either used in jewelry such as necklaces, or woven into larger garments that we lack evidence for. Non-jewelry clothing almost certainly predates the Russian evidence from sites such as Sungir—ironically the material culture from that site is jewelry in the strictest sense, but the beads are laid out in a manner almost certainly indicating their having been sewn into specialised cold-weather animal skin garments. Therefore, at least in Eurasia, ‘soft’ clothing certainly appears before 30,000BP. Furthermore, given the abundant depictions of garments—likely for both thermoregulatory and perhaps decorative purposes—clothing of many types was likely common throughout Eurasia before 30,000BP. Given the oftentimes frigid environments that humans lived in, clothing was likely a prerequisite for their spread throughout Eurasia in the first place. The evidence for Africa is less direct and relies on inferences from well-dated bone tools and lithics. Those inferences suggest that ‘soft’ garments appear before 80,000BP. Those soft garments then spread with humans both to western Eurasia and to East Asia, while perhaps being an independent development in Australia during the LGM.

Taking the direct and indirect evidence for garments together suggests that clothing was first made for decorative purposes and came in the form of jewelry. In the millennia that followed, climatic fluctuations necessitated ‘soft’ garments, likely for the purposes of maintaining their wearer’s body heat. Those garments likely have their origins in Africa. Although given Neanderthals’ use of decorative clothing and the likelihood of their needing to be intermittently covered to exist in Eurasia during the Middle Palaeolithic, 'clothing' more broadly likely originates with them.

2.2.3. Biological evidence for early clothing use

The available archaeological evidence indicates an origin for clothing around or before 130,000BP for decorative clothing, and likely before 80,000BP for non-decorative clothing. However, genetic data related to mutations on melanocortin receptors suggests that hominins have been relatively hairless in appearance since at least 1,200,000BP. These data suggest that the melanocortin I receptor's manufacture of a protein that causes the colouration of human hair and skin only became widely used following our colonisation of the African savannahs and subsequent hairlessness—thus requiring modification of skin colour for the purposes of protection from the sun (Rogers et al. 2004). That hairlessness intuitively ought to have necessitated the development of clothing much earlier than the material evidence suggests. This seeming incongruity between the archaeological and genetic evidence raises questions.

Nuclear and mtDNA data from head and body lice (*Pediculus humanus capitis* and *Pediculus humanus humanus*) date those taxa's speciation between 30,000BP and 114,000BP. Body lice require clothing to lay their eggs. Therefore, the speciation between the two lineages, coupled with louse genetic diversity peaking in Africa, suggests an origin for clothing in Africa at some point since 120,000BP (Kittler et al. 2003). That earliest possible date reconciles well with the evidence for items such as beaded jewelry, though it predates the earliest bone tool and lithic material associated with hide-working. Given the wide range of date estimates, a mean age may be a more appropriate approximation of the lice data. A mean age of 72,000BP reconciles nicely with the archaeological evidence for soft garments. Hairlessness in our lineage may have been selected for due to it reducing parasite loads (Pagel and Bodmer 2003). Therefore, an emerging hairlessness may have had the effect of both reducing the overall burden of louse parasitism on our ancestors while creating a differentiated niche for different louse species to inhabit.

In addition to our unique use of clothing, humans are peculiar among living primates for our seeming hairlessness: though the number and density of our hair follicles are unremarkable compared to our closest cousins, the hairs themselves are relatively small

(Rantala 2007). The reasons for our relatively hairless appearance are contested, though it has been suggested that our ancestors' increasing tendency toward bipedal locomotion made possible the reduction of their body hair via a decrease in exposure to solar radiation on bipedal as opposed to quadrupedal bodies (Wheeler 1984). A problem for the hypothesis that hair loss would have aided the avoidance of thermal stress via a decrease in solar radiation is that thick body hair would have provided thermal advantages in bipedal, savannah-dwelling primates (do Amaral 1996). Alternatively, it has been argued that the innovation of clothing itself, rather than the advent of bipedal locomotion, made thick body hair redundant (Rantala 2007). Linking developments in bipedal locomotion and/or hairlessness to clothing would thus require that either bipedal locomotion made thick hair redundant, which in turn necessitated clothing development for thermoregulatory purposes, or that clothing itself made thick body hair redundant, and that bipedal locomotion does not factor into clothing development directly.

Given the genetic evidence suggesting an early date for a hairless appearance and the much later archaeological evidence for clothing, the suggestion that clothing's development caused a hairless appearance seems unlikely. Assuming a relatively warm environment, clothing would have been more needed by a hairier hominin than a relatively hairless one. Body hair acts to mitigate overheating, thus in part explaining the fact that peoples living closer to the equator tend to carry more of it (Rantala 2007). Therefore, the hypothesis that the development of clothing made body hair redundant is unlikely. The hypothesis that bipedal locomotion made thick hair redundant is possible, but given the evidence, that would leave clothing's development entirely unlinked from our nakedness of body hair.

The balance of evidence indicates that our lineage was both naked and unclothed for most of the last 1.2mya (Rantala 2007). Clothing likely did not make body hair redundant. If it had, we would expect to have seen clothing (for the purposes of insulation) emerge much earlier in our evolution. The archaeological and biological evidence suggests that clothing for the purposes of thermoregulation is a relatively recent innovation—perhaps emerging in Africa around or after 100,000BP, and is independent of our lineage's decrease in body hair over time.

2.2.4. Clothing and human evolution

The archaeological evidence for clothing suggests that it is a relatively recent innovation that postdates our hairlessness by at least a million years. Nonetheless, possible links between bipedal locomotion, hairlessness, and the innovation of clothing entail a walk through the last several million years of hominin evolution as it relates to the development of clothing is worthwhile. The relevant groups of discussion in this section are the putative earliest hominins (*Sahelanthropus*, *Orrorin*, *Ardipithecus*), the australopiths, the paranthropines, the habilines, early humans (*H. erectus, H. heidelbergensis*), and later humans (*H. neanderthalensis, H. sapiens*).

Unsurprisingly given the lack of general material culture associated with the putative earliest hominins, their status as clothes-makers is highly unlikely. *Sahelanthropus, Orrorin*, and *Sahelanthropus* were all likely unclothed. Furthermore, given the aforementioned genetic evidence, all three were likely very hairy. The australopiths are also unlikely clothes-wearers and clothes-makers, and lack much material culture so speak of, and specifically lack any material culture associated with clothing.

The paranthropines—*Paranthropus aethiopicus, Paranthropus robustus, and Paranthropus boisei*—offer something of a contrast with the putative early hominins and australopiths. Functional morphological analysis of the hands of *P. robustus* (Susman 1988) and bone tool finds from South Africa dated to between 1,500,000BP and 2,100,000BP suggest that *P. robustus* was likely the maker and user of the earliest bone tools (Backwell and d'Errico 2008). Despite the early appearance of bone tool material culture, none of it—or any other evidence—has been suggested as being linked to Paranthropine clothing. Thus, paranthropines, like australopiths and the putative early hominins, were probably hairy and unclothed.

The habilines—*Homo habilis, Homo rudolfensis, H. floresiensis, and H. naledi*—despite being associated with some of the earliest fully-fledged and well-attested stone tools (the Oldowan industry in the case of the *H. habilis*, and more well-developed and much more recent tools in the case of *H. floresiensis*) lack any archaeological evidence for clothing use. Given the fact that the habilines existed for more than a million years, their status as 'hairy' or 'relatively hairless' may have varied over time and space, but their status as clothes-wearers is not in doubt. The habilines likely did not employ clothing, based on the available evidence.

Turning now to the early human group of species, *H. erectus* represents the earliest example of a hominin with locomotive energetics similar to that of modern *H. sapiens*, as demonstrated by their increased lower limb to upper limb ratio compared to earlier hominins (Steudel-Numbers 2006). The previously discussed genetic evidence for their relative hairlessness, while unlikely to have any relevance to clothing, emphasises *H. erectus*' broad anatomical and morphological similarities to ours. Despite those similarities, there is no evidence for clothing in the material culture of *H. erectus. H. heidelbergensis*, generally regarded as ancestral to both *H. neanderthalensis* and *H. sapiens* (Stringer 2012), likely represents the last species of Eurasian Homo—with the possible exception of *H. floresiensis*—that was unclothed for, apparently, all of its history. At the very least, we lack material culture suggestive of *H. heidelbergensis* clothing use. Given the previously-mentioned genetic evidence for hominin hairlessness post-1.2mya, *H. heidelbergensis* may have persisted in Europe without clothing at all having entered Europe in the Middle Pleistocene, while having initially evolved in Africa in a relatively warm climate (Dennell et al. 2011). It appeared in Europe during a time of relatively long-lasting and mild climatic cycles compared to those that would dominate Eurasia in later times. The landscape at the time alternated between more open and more closed environments, but maintained relatively comfortable temperatures (García and Arsuaga 2011), perhaps explaining its lack of need for material thermoregulatory aids. Furthermore, they seem to have lacked morphological thermoregulatory aids, at least in the form of craniofacial mechanisms for warming air (Wroe et al. 2018).

H. neanderthalensis, a likely descendant of *H. heidelbergensis* (Stringer 2012), existed in western and north-central Eurasia during the Late Middle Pleistocene and Early-to-Middle Upper Pleistocene. The Late Middle Pleistocene, while not climatically harsh in comparison to later times, was less stable and likely intermittently harsher than Eurasia was during the movement of *H. heidelbergensis* into the continent (García and Arsuaga 2011). Neanderthals, having evolved in a climate harsher than the one their ancestors evolved in, have postcranial characteristics that seem to be adaptations to living in cold environments. Those adaptations—for example a large ribcage and relatively short limbs—bear some similarities to modern humans adapted to Arctic environments (Churchill 2006). Furthermore, the facial structure of Neanderthals has been suggested to represent a series of adaptations to Arctic-like conditions, though that suggestion is not without disagreement (Rae et al. 2011; Wroe et al. 2018). Neanderthals likely had material adaptations to the cold as well. As previously discussed, Neanderthals made some of the earliest decorative clothing in Europe, but archaeological analyses suggest they also made specialised bone tools called 'lissoirs' (Soressi et al. 2013) that are associated with hide-smoothing and potentially clothing use, in addition to their well-known culture of stone tools that may or may not be associated with similar tasks—with scrapers being poor proxies for clothes.

Zooarchaeological evidence for material culture associated with utilitarian clothing use (Collard et al. 2016) suggests that Neanderthals did not often exploit small game necessary for the use of fur trim, which, as discussed, is crucial for hominins avoiding frostbite and hypothermia in particularly cold conditions. Neanderthals employed basic boring tools as well as 'scrapers' that would have been suited, presumably, to simpler clothing—though it bears mentioning that use-wear analyses of Neanderthal scraping implements emphasise their multi-use nature that was often completely decoupled from hide-working (Gilligan 2007; Hardy 2004). In addition to the zooarchaeological and archaeological evidence, Neanderthals are modeled to have needed to cover as much as 80% of their bodies during winter (Wales 2012). Irrespective of the problems associated with their lithic use, Neanderthals were almost certainly using some level of clothing for thermoregulatory purposes throughout their range, at least during cold periods. Given the evidence, their clothing was likely simple and untailored, but sufficed even during particularly cold times (Aiello and Wheeler 2003; Gilligan 2010b; Wales 2012). Therefore, Neanderthals seem to have been anatomically and materially adapted to the climate and environments of the Late Middle Pleistocene and Early Upper Pleistocene of Europe.

The relative climatic stability typical of the Middle Pleistocene Neanderthals initially evolved in would degrade into the Upper Pleistocene (García and Ausuaga 2011). Thus, until the last phase of their occupation of Europe, Neanderthals existed in a climate that was in more flux than *H. heidelbergensis* would have experienced during their colonisation of the continent, but much more stable than the climate chaos that coincided with the appearance of *H. sapiens* in Eurasia. While *H. heidelbergensis* did not have strong pressure to anatomically or materially adapt to cold environments, Neanderthals seem to have experienced exactly that sort of pressure.

The development of Neanderthal clothing within Europe suggests independent evolutions for Neanderthal and later *H. sapiens* clothing, which were discussed earlier in this chapter. Furthermore, despite the evident adequacy of Neanderthals' clothing, the disparity between the complexity of modern human and Neanderthal clothing may have been a contributing factor in the disappearance of Neanderthals in the millennia before the LGM (Tarle 2012; Wales 2012).

Neanderthal and modern human material culture offers a series of interesting counterpoints. Middle Palaeolithic technologies used by Neanderthals may have entailed small resources bases and sporadic exploitation of them. Modern humans possessed material culture such as bone tools and fishing technology that allowed for intensive, consistent exploitation of larger resource bases, and thus, more frequent and consistent technological innovations (Hayden 1990). Material culture contrasts seem to have extended to clothing. The aforementioned exploitation of small fauna by humans and not by Neanderthals (Collard et al. 2016), coupled with differences in either taxon's resource base exploitation suggests a series of snowballing competitive advantages for modern humans, especially in the colder periods of Eurasian prehistory.

The convergence between Neanderthal and modern human clothing is additionally illuminating. As mentioned, Neanderthals made the first garment on record, and also engaged in the earliest decorative behaviour. In the millennia after that innovation, modern humans followed suit and engaged in a great deal of decorative/symbolic behaviour that manifested in the use of garments such as jewelry. Furthermore, modern humans, like Neanderthals, would have required clothing much of the time in the Upper Pleistocene of Eurasia. Much of the clothing would have needed to be of the specialised, cold-weather variety. The evidence for such clothing comes in the form of depictions and preserved garment components suggesting the common use of specialised cold-weather garments by modern humans by before 30,000BP. While both taxa engaged in similar symbolic behaviour and had similar recognition of the need to make garments to keep warm in cold environments, modern humans managed to outlast their contemporaries via their use of both highly visible means (tailored, multi-layered garments) and more subtle ones (fur ruffs, etc.).

Though the association between hominins' growing hairlessness and clothing use is a tempting one, it seems that, given the archaeological, biological, and genetic evidence, humans were relatively hairless well before we were clothed. The putative early hominins, australopiths, paranthropines, habilines, and early humans all seem to have been unclothed. The later humans (*H. neanderthalensis and H. sapiens*) were clothed at least intermittently by 130,000BP in terms of decorative clothing, and in terms of clothing for the purpose of thermoregulation, were clothed by 80,000BP. Clothing, therefore, seems to have been initially developed outside of our species and likely for purely symbolic purposes. At some point, tens of millennia after, clothing was used to protect us from the elements, while certain garments were retained for purely or at least partially decorative/symbolic purposes.

2.3. Hypotheses tested in this study

2.3.1. The Environmental Hypothesis

As noted in Chapter 1, one of clothing's primary functions seems to be to protect people from environmental hazards. In many places and at most times, the primary climate-related environmental hazard is low ambient temperature (which, if not mitigated, can lead to hypothermia and frostbite), and clothing is often designed with protection from the cold in mind. This protection can be achieved both by trapping warm air close to the skin, and by allowing the evaporation of perspiration, which greatly inhibits the clothing's insulation (Chen et al. 2003; Havenith 2003). In addition to being insulating and permeable, clothing designed for protection from the cold needs to prevent the absorption of moisture from the outside environment, which, like sweat, undermines a garment's insulation potential (Ha et al. 1995; Pascoe et al. 1994). The need to mitigate absorption of moisture from the external environment holds true both for the purposes of protecting against heat loss (Wang et al. 2012) and, at least in some cases, protection from overheating (Barker et al. 2006). Overheating, whether caused directly by the environment or the micro-environment of clothing is known to dramatically inhibit mental and physical performance and increase an individual's propensity for accidents (Parsons 2002). Regardless of the potential for overheating under certain circumstances, the more pertinent concern in small-scale societies will be protection from hyperthermia and frostbite. Therefore, the Environmental Hypothesis predicts that:

- The wardrobes of hunter-gatherer groups who live in cold environments will be richer and more complex than those of hunter-gatherer groups who live in warm environments.

- The number and complexity of non-decorative garments will be significantly more strongly correlated with harsher environmental conditions than the number and complexity of decorative garments, due to their role in thermoregulation.

- Hunter-gatherers living in warmer environments will have more decorative garments and richer decorative wardrobes as a percentage of total components/garments. They will have a larger canvas with which to work and will not need to devote as much space to survival clothing. In addition, they will invest more into decoration when investing less into survival clothing is an option. However, this signal will not extend to raw numbers, since temperature variables will dominate clothing design. This prediction also acts as a test of whether investment in decorative clothing was based on time and/or energy availability, or pre-existing attention and/or greater opportunity. If this prediction is supported, then it is likely that hunter-gatherers in warmer environments may be more inclined toward decoration because they have energy and time to devote away from their immediate survival. If the prediction is not supported (especially if the opposite prediction comes to pass), it may instead suggest that hunter-gatherers living in colder environments have more motivation and opportunity to decorate clothing because they already have more of it (i.e., a larger potential canvas size).

- Men's clothing will be more strongly associated with environmental variables related to temperature due to their duties as hunters and fishers.

Groups living in wetter, more humid environments may also need to have clothing designed to mitigate moisture absorption (which can cause the loss of body heat). The loss of body heat in wetter environments will likely be a more serious concern in cooler climates. However, warmer areas of the world are, in general, wetter. Therefore, the precipitation-related aspects of the Environmental Hypothesis predicts that groups living in wetter areas of the world should have wardrobes that conform to certain conditions:

- Groups in high-precipitation areas should have less numerous, less rich wardrobes and garments.

- Groups in high-humidity areas should have less numerous, less rich wardrobes and complex garments.

- Groups in high-snowfall areas should have more rich wardrobes and more complex garments.

- Any positive correlations between precipitation and wardrobe complexity ought to stronger with non-decorative clothing than decorative clothing.

Due to the relatively less hazardous nature of the environmental variables in the precipitation group, there should be no significant differences between the strengths of the correlation between these environmental hazards and men's and women's clothing.

2.3.2. The Economic Hypothesis

There is reason to think that a society's garments ought to correlate with their subsistence activities. Groups who hunt more need to range farther. Groups that gather more will likely need less complex clothing and less rich wardrobes due to their smaller subsistence ranges, which in turn is due to their relative lack of need to follow mobile game (Kelly 1983) and the lack of need for waterproofed clothing. It is likely that these groups rely on fishing, and that activity is a stronger (though still not especially strong) predictor of clothing complexity. Groups that fish at high latitudes use additional, waterproofed garments (Holtved 1967; Jochelson 1908; Murdoch 1892; Osgood 1940), which, while not necessarily more complex on the basis of technounits, still entail larger wardrobes and therefore greater technounit counts compared to clothing in societies that fish less. Furthermore, men engage in riskier subsistence activities than women (Ember 1978). Fishing and hunting are two examples of relatively male-dominated activities that riskier than gathering, which is a subsistence strategy engaged in more often by women. Therefore, the Economic Hypothesis makes several predictions:

- The more a group hunts, the richer wardrobes and more complex garments they will use.

- The more a group fishes, the more complex their garments and richer their wardrobes should be.

- The more a group fishes and hunts, the more layers they should need due to wider ranging from home to acquire resources.

- Subsistence activities should correlate with non-decorative clothing more than with decorative clothing, i.e., decorative clothing and components will also likely be affected by the increased ranging distance required by fishing and hunting.

- Men ought to have richer wardrobes and more complex garments due to their ranging (often needed for hunting) and need for some specialised (often waterproof) garments needed for fishing.

Complex food storage strategies seem to be associated with some aspects of material culture complexity (Testart 1982) though in other cases, such strategies are utilised by technologically simpler societies (Morgan 2012). Complex food storage should correlate with increasing sedentism: a greater population could be supported with more stored calories. In turn, larger, more sedentary populations should yield more complex material culture.

Differences in the degree of mobility or the complexity of food storage techniques may correspond to different levels of clothing complexity. A society's degree of sedentism is argued may be correlated with their ability to carry bulky material culture (Shott 1986) and thus may influence a culture's technological complexity and diversity, and investment in technology (Bright et al. 2002). Those correlations are due in part to the limits on carrying capacity of more mobile societies. On the other hand, it is argued that the links between technological complexity and sedentism are more closely tied to risk management than they are to sedentism (Torrence 1989). My data may shed light on the nature of sedentism, food storage, and technological complexity. The food storage and sedentism facets of the economic hypothesis predicts that:

- Wardrobe richness and garment complexity will correlate positively with more complex food storage strategies.

- Degree of sedentism ought to correlate positively with wardrobe richness and garment complexity.
- Food storage strategies and degree of sedentism ought to correlate with the complexity and number of men's and women's garments equally.
- In addition, degree of sedentism ought to correlate with decorative and non-decorative clothing equally.

2.3.3. The Social Hypothesis

Polygyny seems to have contradictory correlations with products of societies, even between societies living in close proximity with one another. Data from Cote d'Ivoire suggest that men tend to be more polygynous when the cost of labour (of their potential wives) is lower. In other words, women's high work productivity per capita allows men to gather more wives (Jacoby 1995). In a survey of Sub-Saharan Africa, data suggest that polygyny tends to *raise* bride prices rather than lower them. Furthermore, that survey suggests that polygyny positively correlates with fertility but correlates negatively with both societal productivity and financial savings (Tertilt 2005). While the contradictions between the findings related to finances are outside the scope of this section, it is clear that polygyny correlates with a number of economic and social variables. Polygyny may also act as an inhibiting factor on the development of democracy (Korotayev and Bondarenko 2000), suggesting that polygyny may create or reinforce relatively autocratic social systems.

While polygyny seems to have several significant high-level effects on societies, its primary effects are pertinent to outline. A primary effect of polygyny on society is on its reduction of available mates for men. In other words, in a society that allows some degree of polygyny, some—perhaps many—men will be forced to compete for a dwindling resource (mates). The use of clothing is multifaceted and not limited to protection from the environment. One of clothing's secondary functions is as a tool for display (Dunlap 1928). Specifically, clothing often has components used to display sexual interest, availability, or worthiness. Societies have various means of controlling sexuality via marriage (monogamy or different kinds of polygyny) and different tolerances for sexual expression and non-restraint. Monogamy inherently ensures a roughly equal operational sex ratio (OSR), but polygyny entails a biased one. That bias in OSR suggests that men in polygynous societies will be under increased pressure to compete with one another over mates relative to men in monogamous societies. In turn, increased competition via increased inequality, according to traditional models of polygyny (Sanderson 2001), ought to lead to a greater use of decorative clothing components and wardrobes in polygynous societies. Models of Marital Composition that suggest monogamy, rather than polygyny, is associated with greater inequality tend to apply more strongly to complex agricultural societies (Ross et al. 2018), and therefore should not be applicable to this study. Given the aforementioned information, it is predicted that:

- Polygynous societies will have more decorative garments and wardrobes than less polygynous societies.
- Men in polygynous societies will use more decorative clothing than men in monogamous ones relative to either group's women. In other words, the maleness skew of decorative clothing and clothing components will be greater in polygynous societies than in monogamous ones.

Hunter-gatherer societies have variable tolerances toward violence, both within their societies and violence perpetuated against outsiders (Bonta 1996). Some groups actively avoid war, others revel in it. Some groups tacitly accept violence within their communities, and in others, it is absent. An increase in outgroup violence should, in theory, correlate the creation and use of more ostentatious clothing for the purposes of intimidation and perhaps group identification. This is because a propensity for war should stimulate the creation and increased use of more numerous and complex decorations. Similarly, the link between decorativity of wardrobe/garments and ingroup violence should be such that groups engaging in more of it should also be more inclined toward other forms of male-male competition, and therefore should also employ more decorative clothing. Several predictions can be made given the data on ingroup and outgroup violence:

- Societies with more positive views of violence toward outside groups ought to have more complex decorative garments and wardrobes, but not non-decorative ones. Such societies will invest more strongly in decoration due to the strong need for competition.

- Societies accepting of violence within their groups will use more decorative clothing and components.

- More warlike societies will have a greater skew toward male-only decorative garments and decorative clothing components due to the need for men to compete, in war, against other groups of men more often. This pattern will not be observed for non-decorative technounits and garments.

There is reason to think that sexual openness and sexual dimorphism may correlate with wardrobe and garment complexity. If sexuality is expressed more openly in each society, there ought to be less need to ‘show off’. The notion that societies with a freer attitude toward sex ought to correlate with some features of clothing follows from the logic that, if sex is freely available, a great deal of complex decorative clothing likely would not be necessary to advertise sexual availability. The potential links between sexual dimorphism and clothing complexity follow from the observation that polygynous primates tend to be more sexually dimorphic (Clutton-Brock 1985). Increased sexual dimorphism should lead to more male-male competition and thus, more need for ostentatious decorations.

It is not expected that more polygynous societies will have more complex clothing than more monogamous societies, and it is likely that those variables will be uncorrelated. Nevertheless, given that polygynous societies tend towards more intra-sexual competition and violence among males (Wilson and Daly 1985), and given that those same societies tend toward greater sexual dimorphism in height, we can make specific predictions about societies with a greater degree of sexual dimorphism ought to have:

- Societies that have a higher adolescent sexual freedom should have a lower percentage of decorative components due to reduced interpersonal competition for mates.

- Social-sexual selection related to sexual freedom and sexual dimorphism ought to correlate negatively with the richness of decorative wardrobes and garments due to the reduced need for competition in freer societies.

- Sexually freer societies will have less of a male-skew in percentage of decorative garments and components.
- Sexual dimorphism ought to correlate positively with the wardrobe and garment decorativity.

2.3.4. The Population Hypothesis

There are data that suggest that population size positively correlates with technological complexity due to the greater chance of cumulative culture adaptation with a greater population size (Powell et al. 2009). The hypothesis holds that culturally-transmissible skills related to the crafting of material culture have a greater chance of being successfully copied and spreading throughout larger populations, given necessarily imperfect copying of the skills (Henrich 2004). Population density may work similarly. Denser populations should increase transmission frequency and speed, and that frequency and speed should increase additionally when populations are at their most aggregated . Given these arguments, the population size and density hypotheses predict that:

- Wardrobe richness and garment complexity and will be positively correlated with population size and Maximum Aggregated Size.
- Population size ought to positively correlate with both decorative and non-decorative clothing and components equally due to their serving different but both important needs.
- Population size ought to be associated with richness and complexity in both men's and women's clothing variables equally.
- Wardrobe richness and garment complexity will be positively correlated with population density.
- Non-Decorative garment complexity and wardrobe richness will be more strongly associated with population density than will decorative garment complexity and wardrobe richness.

Chapter 3. Materials and methods

In this chapter, I begin by discussing some issues regarding the terminology associated with clothing. Then, I outline Oswalt's method of classifying material culture in detail and the reasons why I adopted it in preference to the classificatory systems that have been used in previous work on the evolution of clothing. Next, I introduce the hunter-gatherer groups that I included in my sample. Subsequently, I outline the variables that I used in the study. Lastly, I discuss the analyses I carried out to test the hypotheses.

3.1. Defining clothing

As previously noted, certain items in my analysis are not conventionally regarded as clothing. The conventional definition of clothing is "items that act to enclose or cover the body" (Gilligan 2010a:17). I opted for a more inclusive definition: any wearable and removable product of human manufacture or modification kept in close contact with the human body, and used primarily for protection from environmental hazards and/or for visually decorative purposes. Jewelry, body paint, and hair oil are notable examples of items that are not typically considered to be clothing but that I decided to place under the umbrella terms of 'garments'/'clothing'. There are items that bear similarities to body paint and hair oil that were excluded, however. For example, insect repellant is similar in form and materials to hair oil and body paint. Others such as bags are certainly garment-like insofar as they are worn in a manner similar to garments. Other processes such as tattoos and scarification bear a certain degree of resemblance to clothing items such as body paint. None of these items are included as 'garments' for reasons I will discuss below.

Bags, being primarily for storage, would not qualify lest other items such as jars and jugs used purely for storage be included. Tattoos also do not qualify due to their permanence. However, jewelry, body paint, and hair oil qualify due to their removability. Items such as perfumes are excluded due to their decorative nature being non-visual. Nonetheless, I acknowledge that, while items such as tattoos and perfumes unambiguously do not fit my definition, others such as certain types of cradles could be argued to fit it. Cradles designed to be left on the ground do not qualify as 'garments', but several ethnographic examples exist of cradles that are strapped to adults and used to transport infants long distances. Such designs resemble carrying straps, which, in certain cultures such as the Polar Inuit (Holtved 1967), are infant-carrying devices integrated directly into parkas. Transportable cradles are removable and are used for (infants') protection from environmental hazards. However, they also bear enough resemblance to items such as bags that their inclusion would warrant a definition of a garment that could be extended to any storage device. I decided that such a definition would be so inclusive as to be useless.

Items that straddle the line between garment and non-garment under my definition are rare and these items tend to be relatively simple regardless. Therefore, regardless of whether I used a classification system that was inclusive or exclusive, the general statistical direction of the data would likely have been similar. The decision to prioritise an exclusive definition of 'garment' is justifiable on the grounds of logical consistency in spite of the likely any minor impacts that using an inclusive definition would have had on the overall direction of the analysis.

All clothing is functional in some sense or another. A jacket can keep its wearer warm, while an elaborate feather headdress can demonstrate one's wealth. These are both functions, but are obviously very different categories of functions. For the purposes of clarity, this study distinguishes between decorative and non-decorative clothing. There was some ambiguity in my terminology. Certain garments in certain environments—loincloths in the tropics, for example—were classified as non-decorative despite not being necessary for protection from the cold in most cases. Decorative was a clearer phrase simply defined as clothing, accessories, or components related to social signalling in some way. Non-Decorative, while generally being related to environmental protection, is a term that excludes clothing or components with any decorative purpose.

Because this study focused on traditional clothing, I excluded all clothing of obvious industrialised origin. In addition, I attempted to exclude recent trade items from my sample on the assumption that those items would have a tendency toward being industrially-produced and therefore not representative of traditional cultures and clothing. Small-scale societies have traded clothing and jewelry amongst themselves since time immemorial, so I made no attempt to exclude unambiguous examples of traditional goods being traded even at the cost of inflating a certain groups' wardrobe sizes with items of certain external origin. For example, Chilkat blankets are Tlingit in origin, but I recognise their use by the Haida as being a part of the Haida wardrobe irrespective of the ultimate origin of the garment. It could be argued that I should have excluded such items, but that would require examining every piece of clothing used by every society in the dataset and excluding any item suspected of having an outside origin. The difficulty of doing that along with the arbitrary distinctions of what constitutes trade items and non-trade items made such a decision unfeasible.

The categorisation of certain garments in the ethnographic literature was particularly troublesome for the purposes of the present study. So-called combination suits, which are common in Polar cultures such as the Koryaks (Jochelson 1908), combine upper and lower torso coverings, and often coverings for the extremities as well. Some combination suits are cobbled together from existing clothing, and others are purpose-built. The former type was counted as one technounit (the stitching) and more technounits for any additional embellishments when explicitly noted by the ethnographer that they were combinations of existing garments, i.e., pants, parkas, and others. The latter type was counted the same as any purpose-built garments were, and due to their complexity, they constituted some of the most technounit-rich items in my dataset.

Certain items are variable in their usage and thus, their status as countable members of a society's wardrobe (i.e., a society's entire repertoire of garments) under my definition can be troublesome. In many cases, ethnographers draw distinctions between items such as leglet, bracelet, and anklet explicitly stating that they are separate items, even while, in most cases, noting that they are differently-sized items of identical manufacture. In other instances, leglets, bracelets, and anklets are explicitly reported to be interchangeable items, used on different body parts by different wearers. In cases of the former type, I took ethnographers at their word and regarded the items as separate in their societies' wardrobes. In cases of the latter type, I again took the ethnographers at their word and counted them as a singular item. My justification for those decisions was that I wanted to avoid second-guessing ethnographers' accounts due to the poor precedent that would set for the difficulty in believing any ethnographic account at all.

While certain accessory garments such as bracelets are often interchangeable and sometimes identical to other classes of item, small-scale societies often do not have a consistent suite of decorations for use on necklaces, and they varied between beads, shells, pieces of coloured cloth, metal trinkets, and many others. In other cases, small-scale societies use several different decorations simultaneously. The simultaneous use of many different decorations seemed, most of the time, to be mutually exclusive with highly variable but single-use decorations on items such as necklaces. Therefore, I used an and/or distinction with regard to the ethnographic record. That is, when an ethnographer noted that a group made a particular garment of X decorative technounit and Y decorative technounit, I counted them as two technounits. When instead a society was recorded as using X decorative technounit or Y decorative technounit, I counted those as one technounit. This method of relying on ethnographers' and/or distinction was the neatest way of handling an unwieldy dataset that I could come up with.

3.2. Quantifying traditional clothing

Attempts have been made to understand garments by examining their benefits for human thermoregulation. The clo metric acts as both a measure of clothing's effectiveness at mitigating heat loss, and of the wearer's comfort level in a given environmental state (Yan and Oliver 1996). A negative clo value would indicate extreme heat stress irrespective of the clothes being worn. A 0 score corresponds to a naked human body. A typical summer ensemble is 0.2 clo, a business suit 1 clo, and a polar weather ensemble around 4 clo. Those values must be regarded as fully applicable only to modern textile clothing as clo values do not account for the clothing worn by Upper Palaeolithic peoples, nor, most of the time, does it account for the plant fibre and animal skin clothing of more recent hunter-gatherers (Gilligan 2018). Generally speaking, higher clo values correspond to more complex tailored clothing, and lower clo values correspond to simpler garments. While the clo is a reasonable means of approximating human comfort in modern garb, it was inadequate. The clos of traditional clothing in the ethnographic record can only be approximated, and that approximation would lead to a loss of data resolution. Therefore, the inability to measure clo values accurately coupled with their inapplicability to the goal of examining clothing complexity in traditional clothing required that I use a different system.

There have been several attempts to classify garments in an effort to make clothing more pliable to deep analysis. To analyse the clothing of many peoples in small-scale societies, a dichotomy between simple and complex clothing is helpful, and has been employed in several papers. Clothing is regarded as simple if it is composed of a single layer and fits loosely, irrespective of the material (Gilligan 2010a; Gilligan 2010b; Gilligan

2018). Complex clothing can be composed of one or more layers and is always fitted (Gilligan 2018). Sewing is necessary for the manufacture of complex clothing, but it can also be present in simple clothing.

Complex clothing can become ingrained in culture and can take on meaning far beyond its aiding in protection from the environment. Such ingrained social meaning can include the creation and maintenance of the concepts of shame and modesty (Gilligan 2018). Therefore, beyond the need for more complex clothing in cold environments, it is reasonable to expect that some components of complex clothing will be engineered to facilitate a role in transmitting and maintaining social mores. If the use of these clothing components transmits society information related to modesty and related concepts, it is reasonable to assume that complex clothing ought to be relatively more decorative than simple clothing, in addition to being more common in cold environments. Nonetheless, that assumption must be understood in two parts: one, the absolute differences in decorativity (i.e., the degree to which a society's wardrobe is devoted to decorative clothing or the degree to which a particular garment is devoted to decorative signalling, by technounit count) between complex and simple garments, and the other, the relative differences in terms of the number of decorative components as a fraction of Whole Wardrobe components.

While previous attempts to classify clothing have been made, they did not offer a strong enough framework for the purposes of this study: examining clothing complexity. Several systems have been created to classify clothing along qualitative lines. For example, Hayden (1990) classified clothing into a tripartite system of Basic capes, Improved capes, and Luxury model garments. Subsequently, Gilligan (2007) classified clothing into simple and complex—designations related to fit and tailoring. Most recently, Collard et al. (2016) classified clothing into cape-like clothing and cold-weather clothing. While these classification systems helped to inspire this analysis, I wanted to quantify the wardrobes and garments of small-scale societies and produce high-resolution data.

My decision to adapt Oswalt's (1972, 1976) method of quantifying material culture was due both to its simplicity and to its ability to provide high-resolution results because of its accounting for irreducible individual components of material culture rather than only their sum totals. Rather than using large categorical bins such as capes, potentially grouping disparate items together, Oswalt's (1972, 1976) method allows garments to be represented as sums of numbers of their irreducible constituent parts. The sums can then be used in conjunction with data related to environmental, social, and other factors to test various hypotheses.

Oswalt's (1972, 1976) method was initially developed for subsistence tools such as spears and nets. It involves reducing material culture into 'technounits': basic, structurally unique components of (in this example) tools that, in turn, form 'subsistants'. Subsistants, in turn, are the food-gathering tools themselves, and in this study are analogous to garments. His work primarily focused on subsistence technology, but in a paper in the late 1980s he touched on other forms of material culture such as habitation structures and clothing (Oswalt 1987).

The method can be applied to any form of material culture, regardless of its complexity. A wooden digging stick, for example, constitutes one technounit irrespective of whether or not wood was removed from the tip in the act of sharpening it, since technounits are additive rather than subtractive (Oswalt 1972; Oswalt 1976). A digging stick with an inlaid metal tip constitutes two technounits, and if that tip were bound to the stick, three technounits. In theory, the use of technounits could be applied to any form of material culture from a digging stick to a computer. Although in the case of advanced modern technology such as computers, the system may become unwieldy due to its need to account for all technounits present.

Multiples of certain components are counted as the same technounit in most contexts. For example, if a fishing weir consists of a dozen identical poles, a dozen identical stones, and a dozen identical branches, it is regarded as a three-technounit subsistant, rather than a 36-technounit one (Oswalt 1972). This is because every pole serves the same function as every other pole. Each stone serves the same function of each other stone, and the same applies to the branches. In the case of a deadfall trap, poles used as walls and poles used as roofing would be counted as separate technounits because they serve different functions. The former case is analogous to a shell bead necklace, in which a dozen shells on a string is counted as a two-technounit piece. The latter case, requiring a discrimination of nearly-identical components on the basis of their function is similar to many garments in my analysis. For example, most garments regarded as pants and shirts have panels dedicated strictly to anterior and posterior parts of the human body. Furthermore, most, if not all shirts have sleeve panels that are strictly meant to be medial and lateral on the human arm. In certain circumstances, garments may be made with identical panels, though those cases are few, and furthermore, acknowledging them in my analysis adds an unneeded layer of complexity and would mean I would have had to employ a two-tiered system of complex and less complex garments.

Oswalt (1972) used unit types as indices for certain subsistants. If a society used three types of arrows for the same task, Oswalt only classified the most complex of the three, therefore making the most complex arrow that a society makes their archetypical ‘arrow’. That classification reflects an embarrassment of riches with regard to certain cultures’ subsistants. With clothing, garments (especially non-decorative or sparsely-decorated ones) fit into fewer categories than do subsistants. A society may have several types of game arrows or several different types of deadfalls, but clothing categories such as shoes, pants, and shirts are broader and more inclusive. In other words, subsistants tend to have more numerous and more obvious group-level categories. Though I deviated from Oswalt’s system on the point of categorising types per se, I follow his method insofar as I included the most complex possible state of embellishment for a given garment. In other words, a parka may be unadorned or highly ostentatious, but I used the most ostentatious forms as unit types. But I count the item in its fully embellished, most complex state. If a certain society makes four different types of parka, they may all do essentially the same thing, but as long as the society’s ethnographer judged them as distinct enough from one another to warrant separate entries, I regarded them as separate items. In doing so, I attempted to strike a balance between capturing variations on designs of garment types while not including every possible minor difference within classes of garments such as parkas or, pants. I record the most embellished and complex forms of garments within these categories, rather than settling for the most complex of all possible garments that may fit into those categories. Essentially, instead of having a unit type such as ‘jacket’ that would be akin to Oswalt’s unit type of an ‘arrow’, I move to smaller scales, bypassing having unit types such as ‘parka’. The unit types I use are largely based on functional criteria. For example, in several ethnographies, ‘parkas’ are differentiated based on season, or degree of waterproofing (either different materials or additional technounits), or the sex of the wearer. My unit types are therefore the most embellished (decoratively speaking) versions of each type of garment within each category. Thus, under ‘parkas’, I may, for example, include a summer parka, a winter parka, a dog-skin parka, and a fishing parka as separate garments, even when they are extremely similar. But the counting of each garment's technounits includes all optional embellishments listed by the ethnographer.

Some changes necessitated by my adaptation of Oswalt's method are less subtle. For example, subsistants have certain complexities that garments lack. Oswalt divided food-getting technology into artifacts and naturefacts. The latter includes, for example, water used to drown prey (Oswalt 1976). Clothing lacks that complexity due to the increased need for modification to make clothing wearable: raw materials used to make clothing tend to need extensive processing to be usable, and thus cannot fit into a category such as naturefacts. Oswalt's analysis of food-getting technology suggests that type of material culture requires more high-level divisions such as artifact versus naturefact that do not have analogues in clothing. However, clothing requires lower-level divisions such as many different types of parka that food-getting technologies may lack.

Following Oswalt's (1972, 1976) original method, I regarded raw materials as equally important to one another and manufacturing time as irrelevant to the complexity of a given article of clothing. The reasons for this decision are pragmatic: raw materials are extremely diverse and unevenly distributed (Oswalt 1972, 1976). Moreover, though manufacturing time may be an interesting variable for analysis for the future, my research, like Oswalt's (1972, 1976) original research, focused purely on end-products rather than processes.

3.3. Sample

My sample comprised 50 small-scale hunter-gatherer societies. A distribution of the sample is shown in Figure 1. The societies in the sample were chosen on the basis of wide geographical distribution and data availability. Constructing a sample with wide latitudinal representation ensured that latitude was controlled for, and that each environmental variable's influence on clothing complexity could be examined in detail.

For a small number of small-scale societies, I used composite data and treated two groups' wardrobes as one. For example, the Miskito and Sumu of Central America were largely seen as inseparable and blended with one another irrespective of deep historical differences between the two (Conzemius 1932). In the case of the Dorobo of Central

Africa, their material culture was scantly-recorded, but what was recorded was apparently identical to that of the Nandi, and indeed largely copied from them (Huntingford 1953). Given that the Dorobo's ethnographer outlined that they and the Nandi were obviously separate societies, I did not wish to exclude the Dorobo on the basis of their 'copying' the material culture of an adjacent group. Such cases were few and were noted as being exceptional by their ethnographers.

In certain societies such as the Koryaks, the material culture sample was complete but some of the environmental and demographic data were not. In limited cases (such as with the needed temperature data), the closely-related Chukchee's data were substituted. The Nenets and Nganasan, despite somewhat greater cultural distance between them compared to the Koryaks and Chukchee, were treated similarly with regard to their demographic and environmental data—the Nganasan data filled a few minor holes in the Nenets' dataset. Nonetheless, those groups were all relatively similar in most regards, and thus, there likely was very little to no compromising of the overall dataset occurring due to the necessary compositing.

Another data point needing clarification is that one (now extinct) group, the Pericúes, required an estimate of population size on the basis of an adjacent group with similar subsistence patterns living in a similar environment (i.e., reliance on hunting and gathering and living in a xeric desert). The population data for the adjacent Guaicura people were used as a baseline (Population Size 977, Population Density 0.06, Area 16,290km^2), but modified to account for the Pericúes' smaller territory, approximating the modern Mexican municipalities of Los Cabos and the southern third of La Paz (Laylander 2000), for a total area of 10,442km^2. Those data coupled with the group's relatively early extinction led to my assumption of a somewhat smaller population (750 people) than the Guaicura people had. For the Pawnee, some demographic data such as population size were contradictory, so averages were taken of available data from several ethnographic accounts. The aforementioned exceptions were infrequent and minor, and any errors presented during the process of averaging or compositing certain data points should have had only minor effects on the results of the analyses.

Figure 1: Map of the distribution of the hunter-gatherer societies included in the sample used in the present study. Note the bias towards North America. This is due to higher quality data being available for that continent.

Many of the ethnographic data were drawn from the Electronic Human Resource Area Files (eHRAFworldcultures.yale.edu/ehrafe) with some additional data from D-Place (d-place.org). The broader ethnographic literature was also used. I searched for both exonyms and ethnonyms due to variability in naming conventions and the disparate nature of many societies' mentions throughout—groups adjacent to one another are often mentioned in sources concentrating strongly on one or the other, not both. Though all the groups in my dataset are classified as hunter-gatherers or primarily hunter-gatherers by eHRAF, their lifeways and subsistence are somewhat variable. Some are exclusive hunter-gatherers, a few engaged in some amount animal husbandry, and some engage in a small to moderate amount of agriculture. To avoid the problem of potentially overly-broad categories, I collected percentage-based subsistence statistics for each of the societies in my sample. The majority of the sample conforms fairly well to their eHRAF classifications, but there was enough variation to justify the use of numerical over categorical data to test subsistence-related hypotheses.

Sources were searched for mentions of or related to clothing. The following keywords and phrases were used: 'clothing', 'clothes', 'cloth', 'woven', 'garb', 'feathers', 'paint', 'body paint', 'oil', 'trade', 'dress', 'dressing', 'dressed', 'jewelry', 'jewels', 'finery', 'decoration', 'decorative', 'adornment', 'adorned', 'embroidered', 'war', 'hunting', ‘foraging’, ‘fishing’, ‘mud’, ‘cover’, ‘craft’, ‘artisan’, ‘countenance’, ‘appearance’, ‘costume’, ‘wardrobe’, ‘finery’, ‘garments’, ‘shaman’, ‘medicine man’, ‘ceremony’, ‘legend’, ‘dream’, ‘story’, and ‘dance’. The last several terms may seem tangential to a search for information on clothing, but in some instances, terms such as ‘legend’ and ‘dance’ pointed me toward accounts of garments that were not included with the remainder of the wardrobes in the ethnographies’ sections on clothing. In addition to the textual searches, I used plates and diagrams when provided. Doing so was essential in certain cases. For example, for much of the Koryaks’ winter clothing, the written descriptions did not fully capture some of the embellishments I noted in the photographs. In other cases, such as the Auin, many of the garments depicted in the photographs were not noted at all in the textual sources.

3.4. Variables

All the dependent and independent variables used in this study are listed in Table 1. In this section, I note each variable’s full name, short name (if necessary), and definition. I also discuss each of the clothing variables and each of the independent variables. After that, I use a Principal Component Analysis to create composite environmental variables. I end by outlining the major divisions in the dataset that will be used to test the hypotheses.

Table 1: Dependent and independent variables used in this study. Variable numbers from Binford (2019), the Ethnographic Atlas, or Standard Cross-Cultural Sample datasets are noted when the variables are derived from these sources.

Full name	**Short name (where appropriate)**	**Definition**
Clothing variables		
Total Number of Garments	TNG	Total number of individual garments in a group's wardrobe.
Total Number of Technounits	TTS	Total number of components of garments in a group's wardrobe.
Average Number of Technounits per Garment	AVE	Total number of technounits in a group's wardrobe divided by the total number of garments in the same group's wardrobe.
Maximum Number of Layers	MNL	Maximum number of layers possible in an ensemble (all possible garment configurations taken into account).
Male Total Number of Garments	Male TNG	Total number of garments noted as being worn only by men.
Female Total Number of Garments	Female TNG	Total number of garments noted as being worn only by women.
Male Total Number of Technounits	Male TTS	Total number of technounits on clothing categorised as "male".
Female Total Number of Technounits	Female TTS	Total number of technounits on clothing categorised as "female".
Male Average Number of Technounits per Garment	Male AVE	Total number of decorative technounits in the male wardrobe divided by the total number of decorative garments in the male wardrobe.
Female Average Number of Technounits per Garment	Female AVE	Total number of decorative technounits in the female wardrobe divided by the total number of decorative garments in the female wardrobe.
Decorative Total Number of Garments	Decorative TNG	Total number of garments in a group's wardrobe with *any* decoration.
Decorative Total Number of Garments	Non-Decorative TNG	Total number of garments in a group's wardrobe without any decoration.

Decorative Total Number of Technounits	Decorative TTS	Total number of technounits in a group's wardrobe with some decorative purpose.
Non-Decorative Total Number of Technounits	Non-Decorative TTS	Total number of technounits in a group's wardrobe with no decorative purpose.
Decorative Average Number of Technounits per Garment	Decorative AVE	Total number of decorative technounits in a group's wardrobe divided by the total number of decorative garments in the same group's wardrobe.
Non-Decorative Average Number of Technounits per Garment	Non-Decorative AVE	Total number of non-decorative technounits in a group's wardrobe divided by the total number of non-decorative garments in the same group's wardrobe.
Percentage of Garments with some Decoration	Percentage of Decorative Garments	Percentage of garments in a group's wardrobe with *any* decorative purpose. A proxy for a society's level of investment in decorative signaling.
Percentage of Technounits with some Decoration	Percentage of Decorative Technounits	Percentage of technounits in a group's wardrobe serving *any* decorative function. A proxy for a society's level of investment in decorative signaling.
Independent variables		
Average Annual Temperature	Temperature	Average yearly temperature. Usually several decades of data, but varied depending on location used (weatherbase.com).
Average Wind Chill	Wind Chill	Average yearly wind chill. Derived from the equation 'AWC = Sum of monthly temperature values / 12' and the result was placed into the Government of Canada's wind chill calculator (weather.gc.ca).
Peak Wind Chill	Peak Wind Chill	Peak Wind Chill was derived only from the three coldest months of the year. Derived from the equation 'PWC = Sum of three coldest months' average temperature values / 3' and the result was placed into the Government of Canada's wind chill calculator (weather.gc.ca).

Average Percentage of Humidity	Humidity	Yearly average of the air's moisture content. In certain instances, Average Percentage of Humidity was not listed, but both Average Morning and Average Evening Humidity were. In those cases, an average of the two values were taken (weatherbase.com).
Average Yearly Precipitation	Precipitation, expressed in mm	Yearly average of the amount of precipitation in any given area (weatherbase.com).
Average Yearly Snowfall	Snowfall, expressed in cm	Yearly average of the amount of snow in any given area (weatherbase.com).
Latitude		Latitude normalised so that southern and northern latitudes are numerically equivalent, i.e. they are all positive numbers.
Distance from the Coast		How far a hunter-gatherer group typically lives from the nearest coastline.
Percentage of Subsistence from Fishing	Fishing	Percentage of total subsistence coming from fishing activities. This is variable 003 in the *Ethnographic Atlas*.
Percentage of Subsistence from Hunting	Hunting	Percentage of total subsistence coming from hunting activities. This is variable 002 in the *Ethnographic Atlas*.
Percentage of Subsistence from Gathering	Gathering	Percentage of total subsistence coming from gathering activities. This is variable 001 in the *Ethnographic Atlas*.
Mobility		Whether a hunter-gatherer group is more mobile or more sedentary. States are 'Mobile' or 'sedentary'. Presented as distinct categories for clarity. This is variable 002 in Binford (2019).
Food Storage		Long-term food storage activities. The codes were 'barely adequate', 'adequate', and 'more than adequate'. This is variable 20 in the Standard Cross Cultural Sample.

Marital Composition		Marital typology based on the following three categories: 'Monogamy', 'Limited Polygny' and 'Strong Polygyny'. This is variable 009 in the *Ethnographic Atlas*. 'Strong Polygyny' was altered to include all four of EA009's non-limited polygyny codes.
Outgroup Violence		Measure of attitude toward war and raiding: 'Avoided', 'Seen as necessary evil', or 'Enjoyed'. This is variable 907 in the Standard Cross Cultural Sample.
Ingroup Violence		Measure of presence of violence—both male-male and male-female—within communities: 'Absent' or 'present'. This is variable 666 in the Standard Cross Cultural Sample.
Adolescent Sexual Freedom Index-Male	Sexual Freedom-Male	The two variables are combined and expressed as a 10-20 scale referring to the degree to which young men are able to exercise choice of mate. '10' indicates low sexual freedom. '20' indicates high sexual freedom. This is the combination of the variables 827 (Sexual Expression) and 829 (Sexual Non-Restraint) in the Standard Cross-Cultural Sample. Both are ordinal variables and are on 1-10 scales, so the combined variable is on a 10-20 scale.

Adolescent Sexual Freedom Index-Female	Sexual Freedom-Female	The two variables are combined and expressed as a 10-20 scale referring to the degree to which young women are able to exercise choice of mate. '10' indicates low sexual freedom. '20' indicates high sexual freedom. This is the combination of the variables 828 (Sexual Expression) and 830 (Sexual Non-Restraint) in the Standard Cross-Cultural Sample. Both are ordinal variables and are on 1-10 scales, so the combined variable is on a 10-20 scale.
Sexual Dimorphism Index	Sexual Dimorphism	Data from Binford's (2019) hunter-gatherer dataset were used to determine degree of sexual dimorphism in height (men's average height / women's average height). These are variables 039 and 040 in Binford (2019).
Population Size		Population size Log10-transformed to account for skewness. A Log10 transform of this was used, but the original variable is variable 202 in the *Ethnographic Atlas*.
Population Density		Population density Log10-transformed to account for skewness. A Log10 transform of this was used, but the original variable is variable 008 in Binford (2019).
Maximum Aggregated Size		Size of population at time of the year when group is most aggregated. This is variable 011 in Binford (2019).

3.4.1. Clothing variables

For each society in the sample, every garment, piece of jewelry, and accessory was noted, and their technounits were quantified using written descriptions and, where available, illustrations.

While the design of garments varied markedly among different groups, there were certain commonalities of design, so certain generalisations were made. For example, many necklaces were composed of a string of shell beads, and thus they were counted as two technounits, despite there being many individual beads, because each bead is a replicant of the same item. Similarly, pants were usually composed of two panels, front and rear, along with stitching or thongs along the sides. This basic template was regarded as three technounits since the stitching is a replicant, but the front and back panels were usually not identical with one another. Additions of belt loops, decorative embellishments, etc. were often present and were counted separately. Following Oswalt (1987), stitching was counted as one technounit per garment irrespective of how many seams were present. In the rare case that a garment used both stitching and other attachment methods such as thongs, the two were counted separately.

The wardrobes I recorded were separated into men's, women's, unisex, and children's, following conventional ethnographic use. Broadly speaking, much of the ethnographic record uses this convention or similar ones, though there are exceptions. Some ethnographers may, for example, split the sex of children's clothing (e.g., Seligman et al. 1911); some may present children's clothing as homogeneous between the sexes (perhaps a reflection of reality, or perhaps a limitation of the data; e.g., Honigmann 1954); and some may not mention children's clothing at all (e.g., Schebesta 1962), which again may or may not be a reflection of ethnographic limitations. Most such distinctions are minor and no information was lost by the ethnographer having made or not made them, though the inconsistent treatment of children's clothing in the ethnographic record underscores the need to exercise caution in searching for data. Regardless, clothing made specifically for children was rare enough to be irrelevant for my analysis and will not be mentioned further. The sex of the wearer of a given garment, in certain entries in the ethnographic record, was ambiguous. In such a circumstance, I assigned such garments to the *unisex* category, and therefore such garments play little role in my analysis due to my general exclusion of unisex clothing.

In addition to the division of clothing by sex, I noted differences in function. Specifically, decorative versus non-decorative clothing and technounits. Non-decorative garments are primarily (but not exclusively) used for thermoregulation, and decorative garments are related to visual social signaling. In addition to differences in purpose for various garments, I noted differences between the purposes of individual technounits.

Decorative technounits are used for social signalling and may be incorporated into garments that are mostly for protection from the elements, purely for decorative signalling, or for both. On the other hand, non-decorative technounits (which make up the majority of the sample) were for any purpose other than social signalling (often, but not always, for protection from the cold).

TNG, TTS, AVE, and MNL were the four main clothing variables. TNG was the total number of garments in a group's wardrobe. TTS was the total number of technounits in a group's wardrobe. I used the definition of a technounit developed by Oswalt (1972, 1976). Thus, technounits are the irreducible components of a garment. AVE was the Average Number of Technounits per Garment in a group's wardrobe (AVE). It was computed by dividing TTS by TNG. MNL was the degree of possible garment layering in any given wardrobe. It was calculated by dividing the body into several zones: 'head', 'torso', 'arms', 'legs', 'hands', 'feet', and 'crotch'. Then, the number of layers per zone are calculated and summed. For example, the Mbuti have an MNL value of '4'. They lack feet, hand, and arm coverings, but have head, torso, crotch, and leg coverings. However, because they lack any under- or over-garments, the highest number of layered zones of the body that the Mbuti could have at any given time would be four. That variable was not necessarily meant to be a representation of people's everyday clothing ensembles (most of the time people will not wear the greatest number of layers available to them—especially Arctic peoples) but was an attempt to test a society's choice of thermoregulatory strategies (e.g., layering versus individual, complex garments). MNL excludes garments used purely for decorative purposes such as necklaces and armbands, but integrates garments that have decorative components, such as parkas with fox tails attached and similar.

The secondary clothing variables are broadly grouped into ones related to decorative versus non-decorative clothing and ones grouped into male and female clothing. The former group includes decorative and non-decorative versions of garments, technounits, and technounits per garment. That group also has Percentage of Decorative Garments and Percentage of Decorative Technounits, which are measures of a society's investment in decoration. The men's versus women's clothing group has men's and women's versions of garments, technounits, and technounits per garment.

3.4.2. Independent variables

The independent variables used in this study were grouped into environmental, economic, social, and population, corresponding to the hypotheses discussed earlier.

The main environmental variables comprised three temperature-related ones—Average Annual Temperature, Average Wind Chill, and Peak Wind Chill—and three precipitation-related ones—Average Relative Humidity, Average Yearly Precipitation, and Average Yearly Snowfall. Average Annual Temperature is the average temperature over a full year. Average Wind Chill is the mean wind chill value over the course of a full year. It was calculated by taking the average temperature and average wind speed and applying them to the equation Wind Chill = 13.12 + (.6215 x T) - (11.37 x V0.16) + (.3965 x T x V0.16) where T was temperature and V was wind speed (weather.gc.ca). Peak Wind Chill is the mean wind chill over only the three coldest months of the year, but applied to the same equation as the previous variable. Average Relative Humidity is a value expressing the air's carrying capacity for moisture and its current saturation. It was calculated via dividing the partial pressure of water vapour in the mixture to the equilibrium vapour pressure of water for any given temperature. Average Yearly Precipitation is the amount of rain and snow falling, on average, over the course of a full year. These data are based on variable numbers of years, but tended to be calculated with several decades of data. Average Yearly Snowfall is the amount of snow falling, on average, over the course of the year. These data are also based on variable numbers of years depending on the group the data were ascribed to, but tended to be calculated with several decades of data.

I also collected values for four additional environmental variables—Wind Speed, Elevation, Latitude, and Distance from the Coast. Wind Speed is the average velocity of air. Elevation is the number of metres an object (or landscape) was above sea level. Latitude is normalised (both North and South latitudes are counted as positive values). Distance from the Coast is the distance (in km) that a hunter-gatherer group lives from the nearest coast of an ocean or sea.

The environmental values relevant to this analysis were derived largely from D-Place (www.d-place.org). Where necessary, I also consulted other sources, including Timeanddate (www.timeanddate.com), Weatherbase (www.weatherbase.com), Weather-and-climate (www.weather-and-climate.com), The Government of Canada's Wind Chill and Humidex Calculators (www.weather.gc.ca), and Windfinder (www.windfinder.com).

Several of the environmental variables clearly overlap to some extent, including Average Wind Chill, Peak Wind Chill, and Average Annual Temperature. With this in mind, I subjected the environmental variables to a Principal Component Analysis in an effort to generate composite variables that better capture the variation in the dataset.

The PCA returned two main PCs, which explained 51.9% and 25.5% of the variation, respectively. The weighting of the variables on PC1 and PC2 are shown in Table 2. As can we seen, there is a strong positive weighting on PC1 for Average Annual Temperature (.302), Average Wind Chill (.278), Peak Wind Chill (.310), and a weaker positive weighting for Average Yearly Precipitation (.099), along with a weak negative weighting for Average Relative Humidity (-.143), and a moderate negative weighting for Average Yearly Snowfall (-.172) on PC1. On PC2, the temperature-related variables are all weighted weakly (Average Annual Temperature is weighted positively at .051; Average Wind Chill is weighted negatively at -.011; and Peak Wind Chill is weighted positively at .003). On the other hand, the precipitation-related variables are all weighted more strongly, and all are weighted positively (Average Yearly Precipitation .545; Average Relative Humidity .582; Average Yearly Snowfall .111). Plotting PC1 and PC2 against latitude and distance from the coast indicated that PC1 is best understood as latitudinality (Figure 3) while PC2 is best understood as continentality, though the relationship between PC2 and Distance from the Coast did not reach statistical significance (Figure 4).

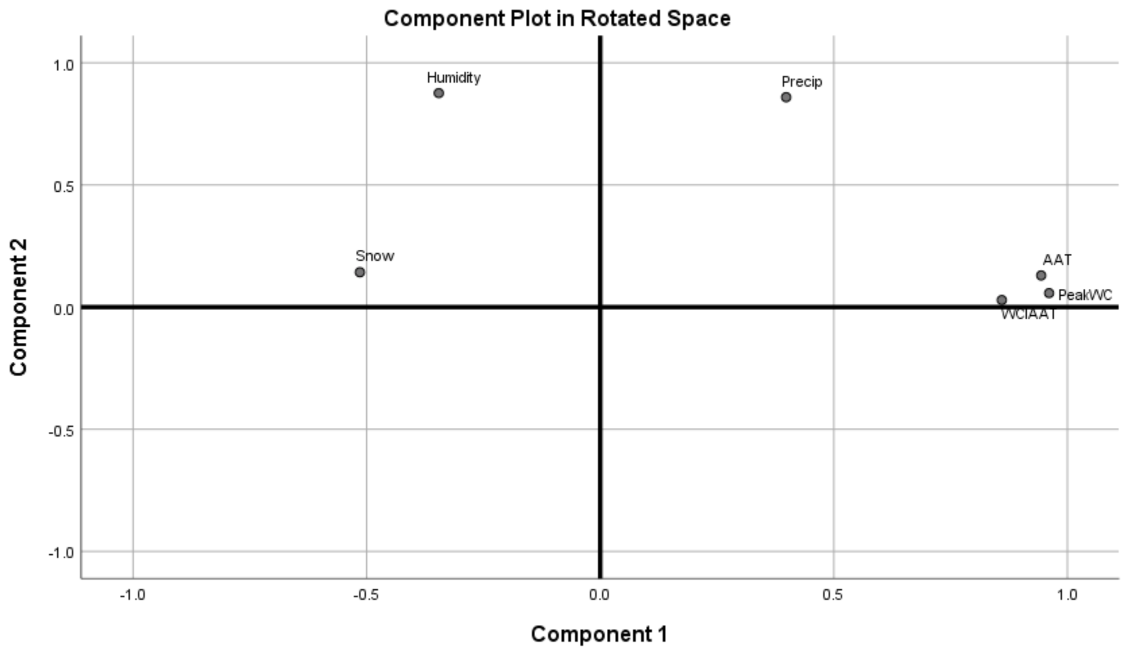

Figure 2: Plots of first two Principal Components yielded by the PCA of the environmental variables. Together, the two PCs explain ca. 77% of the variance in the sample.

Table 2: Component Score Coefficient Matrix of the PCA in Figure 2.

Component Score Coefficient Matrix

	Principal Component	
	1	**2**
Average Annual Temperature	.302	.051
Average Wind Chill	.278	-.011
Peak Wind Chill	.310	.003
Average Yearly Precipitation (mm)	.099	.545
Average Relative Humidity	-.143	.582
Average Yearly Snowfall (cm)	-.172	.111

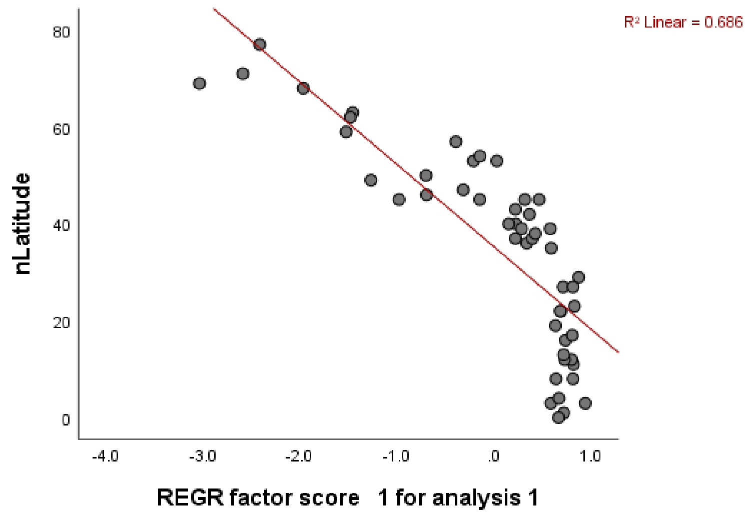

Figure 3: PC1 plotted against normalised latitude. The adj-r^2 is -0.679 (p=.000).

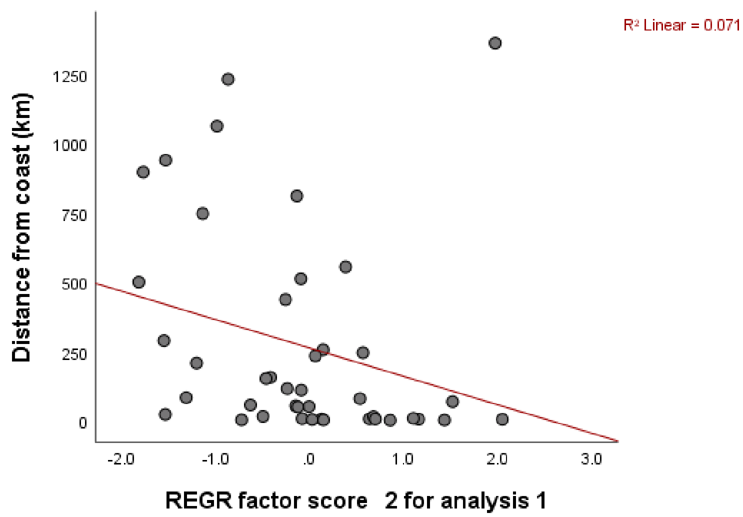

Figure 4: PC2 plotted against distance from the coast. The adj-r^2 is -0.048 (p=.087).

The economic variables included three related to subsistence—Percentage of Subsistence from Fishing, Percentage of Subsistence from Hunting, and Percentage of Subsistence from Gathering. They also included degree of Mobility and Food Storage capabilities. The latter two variables are categorical. Mobility included hunter-gatherers that are either ‘mobile’ or ‘sedentary’. Food Storage included groups that have ‘barely adequate’, ‘adequate’, or ‘more than adequate’ food storage strategies. The values and definitions for these variables were derived from D-Place.

The social variables included the following categorical variables: Marital Composition (‘Monogamy’, ‘Limited Polygyny’ and ‘Strong Polygyny’) which is a measure of degree of hunter-gatherer polygyny. Outgroup Violence (‘Avoided’, ‘(seen as a) Necessary Evil’ and ‘Enjoyed’), which is a measure of how warlike a hunter-gatherer group was. Ingroup Violence (‘Absent’ or ‘Present’), which is a measure of whether a group engages in violence within their own communities. Adolescent Sexual Freedom (both Male and Female), which is a measure of the degree of choice young men and women have in terms of their sexual partners. And Sexual Dimorphism Index, which is the degree of height difference between men and women the values and definitions for these variables were derived from D-Place.

A last set of independent variables I used were related to population size. In an attempt to account for skew in the dataset, I used a Log10 transform of population size, a Log10 transform of population density, and a measure of a society’s peak population in its most aggregated state (Maximum Aggregated Size). Again, the values and definitions of these variables were derived from D-Place.

3.5. Analyses

My analyses tested four hypotheses—the Environmental Hypothesis, the Economic Hypothesis, the Social Hypothesis, and the Population Hypothesis. Each hypothesis was tested against three versions of the dataset: the first was the Whole Wardrobe; the second was Male vs. Female clothing; and the third was Decorative vs. Non-Decorative clothing. All the analyses were carried out in SPSS.

3.5.1. Whole wardrobe analyses

I first tested the hypotheses with the whole wardrobe dataset. I began by plotting each of the primary clothing variables—TNG, TTS, AVE, and MNL—against the main environmental variables—Average Annual Temperature, Wind Chill, Peak Wind, Humidity, Average Yearly Precipitation, and Average Yearly Snowfall. Then, I used simple linear regression to predict the relationship between the environmental variables and the clothing variables. In addition to the simple linear regressions, I performed a stepwise multiple regression analysis to determine the most influential predictors of variation for each clothing variable.

Next, I repeated the process with the economic variables Percentage of Subsistence from Fishing, Percentage of Subsistence from Hunting, and Percentage of Subsistence from Gathering. The categorical variables Food Storage and Mobility were treated differently. For these variables, I generated box plots depicting the four key clothing variables with the hunter-gatherer groups categorised by their Food Storage strategies and Mobility.

Thereafter, I repeated the same process for the social variables Sexual Dimorphism Index, Sexual Freedom Index-Male, and Sexual Freedom Index-Female. The categorical variables Marital Composition, Ingroup Violence, and Outgroup Violence were treated differently. For these variables, I generated box plots depicting the four aforementioned clothing variables with the hunter-gatherer groups categorised by their Marital Composition, Ingroup Violence, and Outgroup Violence.

Lastly, I repeated this process for the population variables Population Size, Population Density, and Maximum Aggregated Size. For these variables, I used simple linear regression to predict the relationship between the them and the clothing variables. In addition to the simple linear regressions, I performed a stepwise multiple regression analysis to determine the most influential predictors of variation in each clothing variable.

3.5.2. Male versus female clothing analyses

In the second set of analyses, I repeated each of the analyses discussed in Section 3.5.1., except that the dataset was divided into male and female clothing. Each of the clothing variables had both a male (Male TNG, Male TTS, Male AVE, and Male MNL), and a female (Female TNG, Female TTS, Female AVE, and Female MNL) version. Each of the variables were used to test, in turn, the Environmental Hypothesis, the Economic Hypothesis, the Social Hypothesis, and the Population Hypothesis.

3.5.3. Decorative versus Non-Decorative clothing analyses

In the third set of analyses, I repeated the same processes described in Sections 3.5.1. and 3.5.2., except that the dataset was divided into decorative and non-decorative clothing. I used both the decorative and the non-Decorative versions of each clothing variable (i.e. Decorative TNG, Decorative TTS, and Decorative AVE, Non-Decorative TNG, Non-Decorative TTS, and Non-Decorative AVE), as well as the ratio variables Percentage of Decorative Garments and Percentage of Decorative Technounits. Each of the variables as used to test the Environmental Hypothesis, the Economic Hypothesis, the Social Hypothesis, and the Population Hypothesis. One notable difference between the analyses of Decorative and Non-Decorative clothing and the Whole Wardrobe group is that, for the former, I omitted testing the hypothesis with the Maximum Number of Layers variable. The reason I omitted this variable is that layers cannot be decorative. Therefore, their analysis would have been pointless.

Chapter 4. Results

In this chapter, I present the results of my tests of the environmental, economic, social, and population hypotheses outlined in Chapter 4. To reiterate, I carried out three sets of analyses, one focused on the Whole Wardrobe (i.e. all the clothing data), one in which I analyses men's and women's clothing separately, and one in which I analysed decorative versus non-decorative garments and technounits separately.

4.1. WHOLE WARDROBE

In analysing the Whole Wardrobe without separating garments by the sex of their wearer or their purpose, I aimed to identify large patterns in the overall dataset.

4.1.1. Descriptive statistics for, and relationships among, the clothing variables

Table 3 summarises the descriptive statistics for the four clothing variables. The values for TNG (Total Number of Garments) ranged between one and 49, with a mean of 21, while those for TTS (Total Number of Technounits) ranged between one and 227, with a mean of 63. The values for AVE (Average Number of Technounits per Garment) ranged between one and seven, with a mean of three. The last clothing variable, MNL (Maximum Number of Layers), ranged between one and 16, with a mean of six. TNG, AVE, and MNL all had relatively small standard deviations. However, the standard deviation of TTS was nearly as large as its mean, which indicated that the greatest variation in cross-cultural clothing complexity is at the component level rather than at the garment level.

Table 3: Descriptive statistics for the four clothing variables when the Whole Wardrobe is considered.

Clothing variable	Minimum	Maximum	Mean	Std. Deviation
TNG	1	49	21.38	10.10
TTS	1	227	63.06	56.32
AVE	1	6	2.55	1.25
MNL	1	16	6.38	4.04

All of the clothing variables were significantly and positively correlated with one another (Table 4). However, TNG was less strongly correlated with TTS, AVE, and MNL than any of those three variables were with one another.

*Table 4: Relationships between the four clothing variables for the Whole Wardrobe. *Relationship is significant (2-tailed).*

	TTS	AVE	MNL
TNG	r^2=0.873, p=.000*	r^2=0.741, p=.000*	r^2=0.820, p=.000*
TTS	-	r^2=0.947, p=.000*	r^2=0.905, p=.000*
AVE		-	r^2=0.898, p=.000*

4.1.2. Tests of the Environmental Hypothesis

4.1.2.1. Total Number of Garments

Figure 5 depicts the relationships between TNG and each of the environmental variables. TNG was negatively associated with Annual Average Temperature, Average Wind Chill, Peak Wind Chill, and Average Yearly Precipitation, but positively associated with Average Relative Humidity and Average Yearly Snowfall. The directions of the associations were as predicted by the Environmental Hypothesis with the exception of Average Yearly Precipitation, which was expected to be have a positive relationship with TNG.

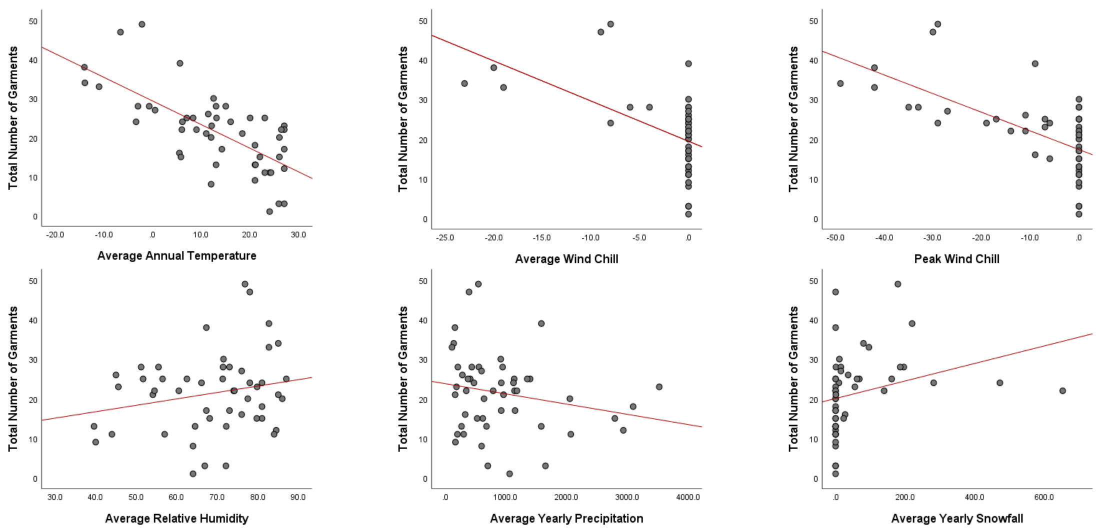

Figure 5: Scatter-plots showing the relationships between Total Number of Garments and each of the six environmental variables.

The results of the analyses in which TNG was regressed on each of the six environmental variables are summarised in Table 5. Four of the six relationships were statistically significant. These were the ones involving Average Annual Temperature, Average Wind Chill, and Peak Wind Chill. These relationships were all in the direction predicted by the Environmental Hypothesis: TNG increased with decreased Annual Average Temperature, and increased Average Wind Chill, Peak Wind Chill, and Average Yearly Snowfall.

*Table 5: Simple linear regression results for Total Number of Garments (TNG) and the environmental variables. *Relationship is significant (2-tailed).*

	Annual Average Temperature	Average Wind Chill	Peak Wind Chill	Average Relative Humidity	Annual Yearly Precipitation	Average Yearly Snowfall
TNG	r^2=-0.474 p=.000*	r^2=-0.268 p=.000*	r^2=-0.403 p=.000*	r^2=0.025 p=.142	r^2=-0.024 p=.145	r^2=0.058 p=.050*

The stepwise multiple regression analysis focused on TNG indicated that Annual Average Temperature was the only significant predictor variable, explaining ca. 47% of the variation in TNG (adjusted-r^2=-0.474, p=.000). Again, the relationship between TNG and Annual Average Temperature was in the direction predicted by the Environmental Hypothesis.

4.1.2.2. Total Number of Technounits

Figure 6 depicts the relationships between the clothing variable TTS and each of the six environmental variables. TTS was negatively associated with Average Annual Temperature, Average Wind Chill, Peak Wind Chill, and Average Yearly Precipitation, but was positively associated with Average Relative Humidity and Average Yearly Snowfall. The relationships were all in the predicted direction with the exception of Average Yearly Precipitation. That relationship was negative, but was predicted to be positive due to hunter-gatherers' need for specialised raingear.

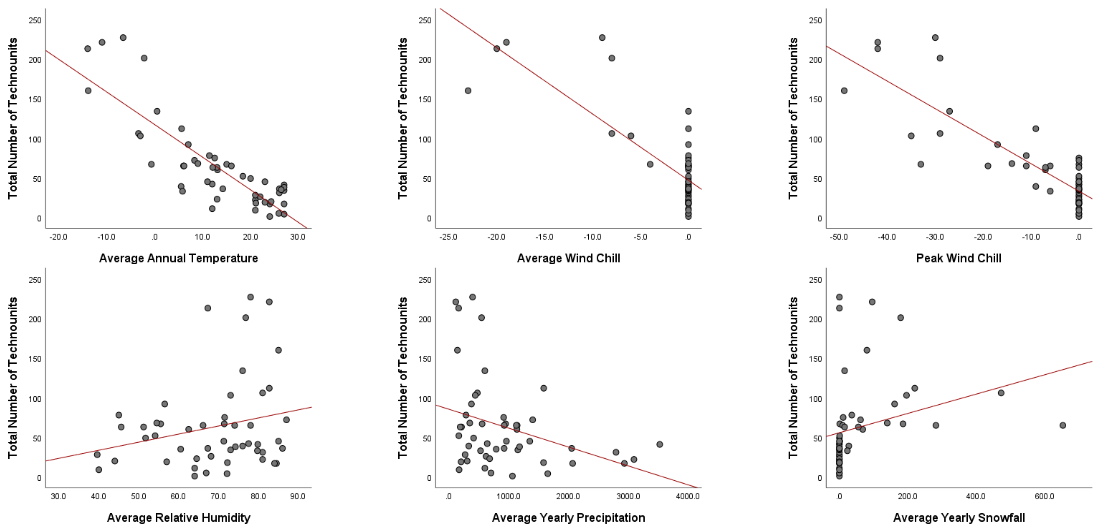

Figure 6: Scatter-plots showing the relationships between Total Number of Technounits and each of the six environmental variables.

The results of the analyses in which TTS was regressed on the environmental variables are summarised in Table 6. Four of the six relationships were statistically significant. These were the ones involving Average Annual Temperature, Average Wind Chill, Peak Wind Chill, and Annual Yearly Precipitation.

*Table 6: Simple linear regression results for Total Number of Technounits (TTS) and the environmental variables. *Relationship is significant (2-tailed).*

	Annual Average Temperature	Average Wind Chill	Peak Wind Chill	Average Relative Humidity	Annual Yearly Precipitation	Annual Yearly Snowfall
TTS	r^2=-0.705 p=.000*	r^2=-0.606 p=.000*	r^2=-0.712 p=.000*	r^2=0.036 p=.099	r^2=-0.100 p=.014*	r^2=0.055 p=.055

The stepwise multiple regression analysis focused on TTS returned two models. In the first, Peak Wind Chill, explained 71% of the variation in TTS (adjusted-r^2=-0.712, p=.000). The relationship between Peak Wind Chill and TTS was in the predicted direction. In the second model, both Peak Wind Chill and Average Annual Temperature were retained. Together, these variables explained approximately 75% of the variation in TTS (adjusted-r^2=-0.745, p=.000). The relationships between TTS and Peak Wind Chill and between TTS and Annual Average Temperature were also in the direction predicted by the Environmental Hypothesis: TTS increased with increased Peak Wind Chill and decreased Average Annual Temperature.

4.1.2.3. Average Number of Technounits per Garment

Figure 7 depicts the relationships between the clothing variable AVE and each of the six environmental variables. AVE was negatively associated with Average Annual Temperature, Average Wind Chill, Peak Wind Chill, and Average Yearly Precipitation. In contrast, it was positively associated with Average Relative Humidity and Average Yearly Snowfall. These relationships were all in the predicted direction with the exception of Average Yearly Precipitation. The relationship between AVE and Average Yearly Precipitation was negative, but was predicted to be positive due to hunter-gatherers' need for specialised raingear.

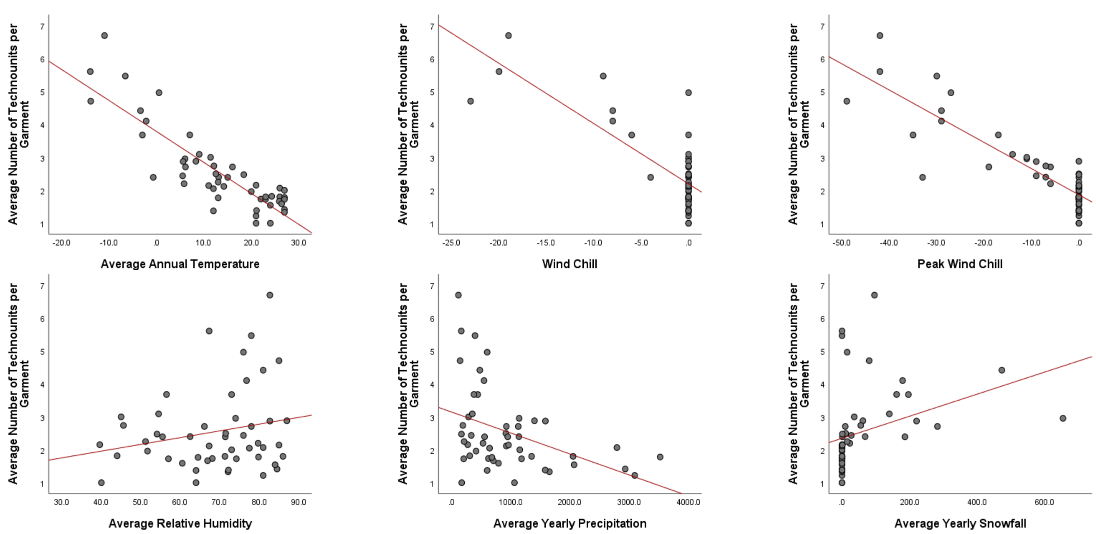

Figure 7: Scatter-plots showing the relationships between the clothing variable Average Number of Technounits per Garment and each of the six environmental variables.

The results of the analyses in which AVE was regressed on each of the six environmental variables are summarised in Table 7. Five of the six relationships were statistically significant. These are the ones involving Average Annual Temperature, Average Wind Chill, Peak Wind Chill, Average Yearly Precipitation, and Average Yearly Snowfall.

*Table 7: Simple linear regression results for Average Number of Technounits per Garment (AVE) and the environmental variables. *Relationship is significant (2-tailed).*

	Average Annual Temperature	Average Wind Chill	Peak Wind Chill	Average Relative Humidity	Average Yearly Precipitation	Average Yearly Snowfall
AVE	r^2=-0.746 p=.000*	r^2=-0.578 p=.000*	r^2=-0.758 p=.000*	r^2=0.026 p=.136	r^2=-0.154 p=.003*	r^2=0.096 p=.016*

The stepwise multiple regression analysis focused on the AVE produced two models. One of these contained a single independent variable, Peak Wind Chill, which explained approximately 76% of the variation in AVE (adjusted-r^2=-0.758, p=.000). The relationship between AVE and Peak Wind Chill was as predicted by the Environmental Hypothesis. The other model included two independent variables, Peak Wind Chill and Average Annual Temperature. Together, these variables explained just over 79% of the variation in AVE (adjusted-r^2=-0.792, p=.000). The relationships implied by the model were both as predicted by the Environmental Hypothesis: the relationships between AVE and both Peak Wind Chill and Average Annual Temperatures were negative.

4.1.2.3. Maximum Number of Layers

Figure 8 depicts the relationships between the clothing variable MNL and each of the six environmental variables. MNL was negatively associated with Average Annual Temperature, Average Wind Chill, Peak Wind Chill, and Average Yearly Precipitation, but positively associated with Average Relative Humidity and Average Yearly Snowfall. These relationships were all in the direction predicted by the Environmental Hypothesis with the exception of Average Yearly Precipitation. The relationship between MNL and Average Yearly Precipitation was predicted to be positive due to hunter-gatherers' need for specialised raingear.

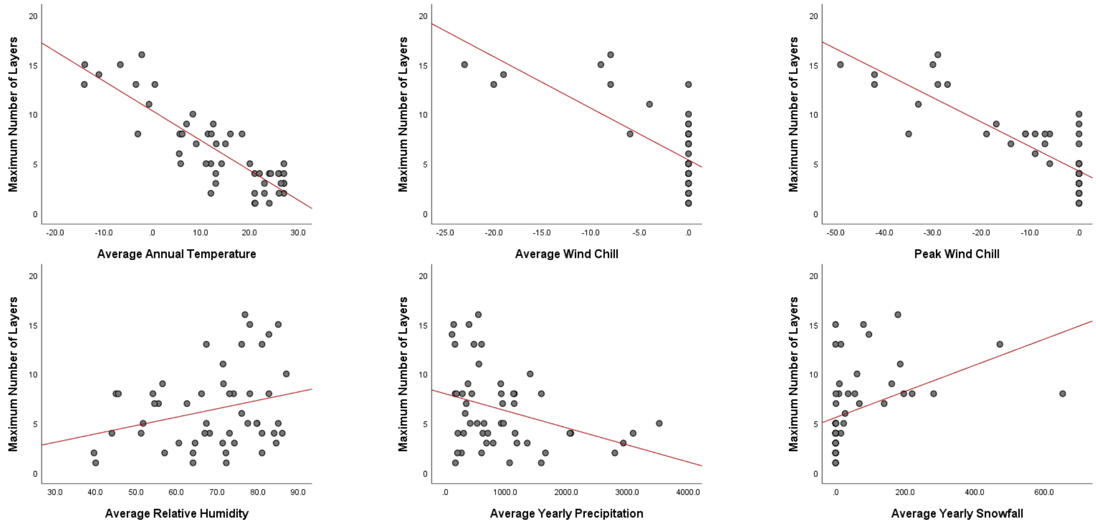

Figure 8: Scatter-plots showing the relationships between the clothing variable Maximum Number of Layers and each of the six environmental variables.

The results of the analyses in which MNL was regressed on each of the six environmental variables are summarised in Table 8. Five of the six relationships were statistically significant. These were the ones involving Average Annual Temperature, Average Wind Chill, Peak Wind Chill, Average Yearly Precipitation, and Average Yearly Snowfall.

*Table 8: Simple linear regression results for Maximum Number of Layers (MNL) and the environmental variables. *Relationship is significant (2-tailed).*

	Average Annual Temperature	Average Wind Chill	Peak Wind Chill	Average Relative Humidity	Average Yearly Precipitation	Average Yearly Snowfall
MNL	r^2=-0.736 p=.000*	r^2=-0.454 p=.000*	r^2=-0.703 p=.000*	r^2=0.056 p=.054	r^2=-0.103 p=.013*	r^2=0.154 p=.003*

The stepwise multiple regression analysis focused on MNL indicated yielded two models. The first featured a single independent variable, Average Annual Temperature, which accounted for approximately 74% of the variation in MNL (adjusted-r^2=-0.736, p=.000). The relationship between MNL and Average Annual Temperature was as predicted by the Environmental Hypothesis. In the second model, Peak Wind Chill was added. Together, Average Annual Temperature and Peak Wind Chill explained about 76% of the variation in MNL (adjusted-r^2=-0.759, p=.000). The relationships implied by the model were both as predicted by the Environmental Hypothesis: the relationship between MNL and both Peak Wind Chill and Average Annual Temperature was negative.

4.1.2.4. Summary of tests of Environmental Hypothesis using data for Whole Wardrobe

Across all four clothing variables, temperature-related variables were much more influential than precipitation-related variables were. For TNG, the most influential environmental variable was Average Annual Temperature. For TTS and AVE, Peak Wind Chill and Average Annual Temperature were the most influential. For MNL, Average Annual Temperature and Peak Wind Chill were the most influential.

4.1.3. Tests of the Economic Hypothesis

4.1.3.1. Total Number of Garments

Figure 9 depicts the relationships between the clothing variable TNG and the three economic variables. TNG was negatively associated with Percentage of Subsistence from Hunting and Percentage of Subsistence from Gathering, but was positively associated with Percentage of Subsistence from Fishing. The relationships are in the directions predicted by the Economic Hypothesis: groups relying more heavily on fishing should need more garments, and groups relying more heavily on gathering should have fewer due to their more limited capacity to carry objects and less exposure to riskier subsistence strategies.

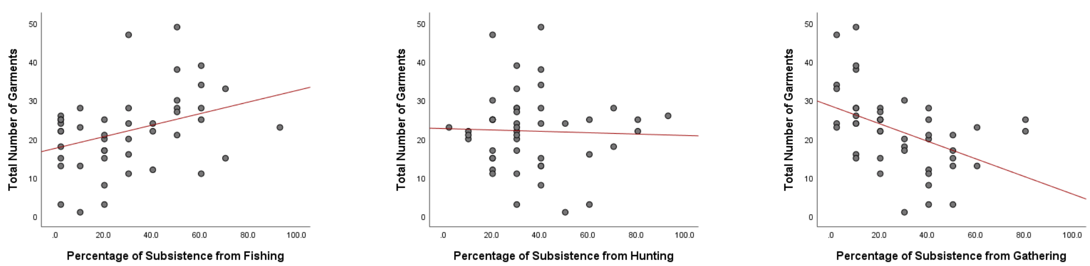

Figure 9: Scatter-plots showing the relationships between the clothing variable Total Number of Garments and each of the subsistence variables.

The results of the analyses in which TNG was regressed on the economic variables are summarised in Table 9. Only one of the three relationships was statistically significant, TNG vs Percentage of Diet from Gathering.

*Table 9: Simple linear regression results for Total Number of Garments (TNG) and the economic variables. *Relationship is significant (2-tailed).*

	Percentage of Subsistence from Fishing	**Percentage of Subsistence from Hunting**	**Percentage of Subsistence from Gathering**
TNG	r^2=0.105 p=.106	r^2=-0.021 p=.816	r^2=-0.190 p=.001*

The stepwise multiple regression analysis focused on TNG indicates that, in a one-variable model, Percentage of Subsistence from Gathering was the only important predictor variable, with an adjusted-r^2 of -0.190 (p=.001). The relationship between TNG and Percentage of Subsistence from Gathering was in the direction predicted by the Economic Hypothesis.

The results of analyses of Total Number of Garments plotted against the categorical variables Food Storage and Mobility are presented in Figure 10. These results suggested that hunter-gatherers with more complex food storage strategies have more garments. Moreover, the results suggested that more sedentary hunter-gatherers have more garments. These results were as predicted by the Economic Hypothesis: less mobile groups should be able to afford to invest more material and energy in garments.

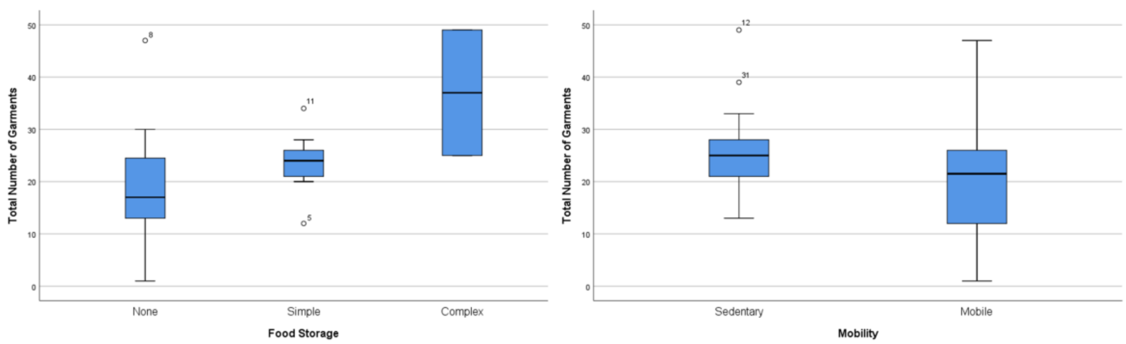

Figure 10: Box plots depicting the relationships between Total Number of Garments and the categorical variables Food Storage and Mobility.

4.1.3.2. Total Number of Technounits

Figure 11 depicts the relationships between the clothing variable TTS and the independent economic variables Percentage of Subsistence from Fishing, Percentage of Subsistence from Hunting, and Percentage of Subsistence from Gathering. TTS was negatively associated with Percentage of Subsistence from Gathering, but was positively associated with Percentage of Subsistence from Fishing. Percentage of Subsistence from Hunting was not associated. The directions of the relationships are as predicted by the Economic Hypothesis: groups relying more heavily on fishing will have more complex clothing due to their needing specialised waterproof garments. Groups relying more heavily on gathering would need to have less complex clothing due to their lack of exposure to risky subsistence methods.

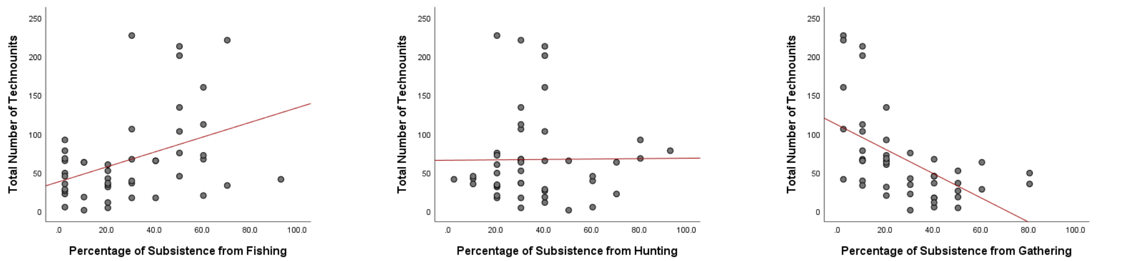

Figure 11: Scatter-plots showing the relationship between the clothing variable Total Number of Technounits and the subsistence variables.

The results of the analyses in which TTS was regressed on the economic variables are summarised in Table 10. One of the three relationships was statistically significant (Percentage of Subsistence from Gathering).

*Table 10: Simple linear regression results for Total Number of Technounits (TTS) and the economic variables. *Relationship is significant (2-tailed).*

	Percentage of Subsistence from Fishing	Percentage of Subsistence from Hunting	Percentage of Subsistence from Gathering
TTS	r^2=0.138 p=.006*	r^2=0.023 p=.953	r^2=-0.288 p=.000*

The stepwise multiple regression analysis focused on TTS indicates that Percentage of Subsistence from Gathering is the only important predictor of variation in TTS, with an adjusted-r^2 of -0.288 (p=.000). The association between TTS and Percentage of Subsistence from Gathering is as predicted by the Economic Hypothesis. However, the lack of importance ascribed to Percentage of Subsistence from Fishing was not.

The results of analyses of TTS plotted against the categorical variables Food Storage and Mobility are presented in Figure 10. These results suggested that hunter-gatherers with more complex food storage strategies have more TTS. Moreover, the results suggested that more sedentary hunter-gatherers have more TTS. These results are as predicted by the Economic Hypothesis: groups with more complex food storage techniques and more sedentary groups have more complex garments due to their ability to invest in and carry more complex clothing.

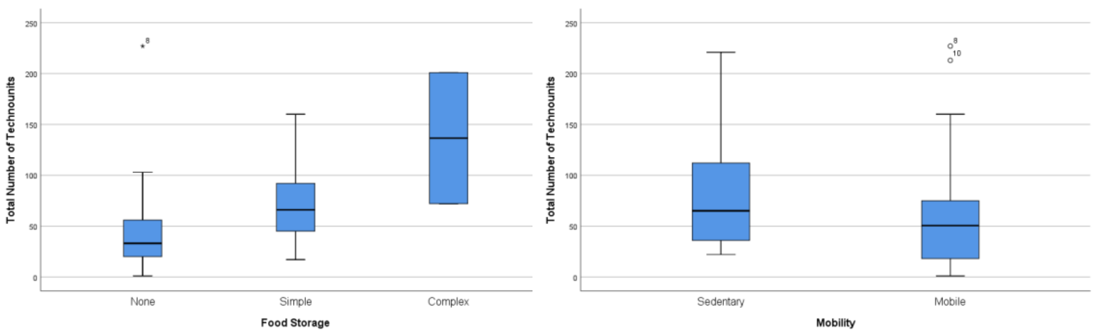

Figure 12: Box plots depicting the relationships between Total Number of Technounits and the categorical variables Food Storage and Mobility.

4.1.3.3. Average Number of Technounits per Garments

Figure 13 depicts the relationships between the clothing variable AVE and the independent economic variables Percentage of Subsistence from Fishing, Percentage of Subsistence from Hunting, and Percentage of Subsistence from Gathering. AVE was negatively associated with Percentage of Subsistence from Gathering, but was positively associated with Percentage of Subsistence from Fishing. Percentage of Subsistence from Hunting was not associated. These directions are as predicted by the Economic Hypothesis.

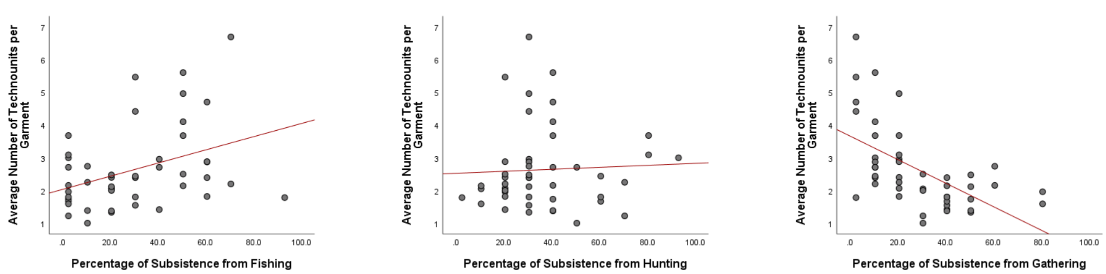

Figure 13: Scatter-plots showing the relationship between the clothing variable Average Number of Technounits per Garment and the subsistence variables.

The results of the analyses in which AVE was regressed on the economic variables are summarised in Table 11. One of the three relationships was statistically significant (Percentage of Subsistence from Gathering).

*Table 11: Simple linear regression results for Average Number of Technounits (AVE) per Garment and the economic variables. *Relationship is significant (2-tailed).*

	Percentage of Subsistence from Fishing	Percentage of Subsistence from Hunting	Percentage of Subsistence from Gathering
AVE	r^2=0.124 p=.009*	r^2=0.020 p=.752	r^2=-0.314 p=.000*

The stepwise multiple regression analysis focused on AVE indicated that, in a one-variable model, Percentage of Subsistence from Gathering was the only important predictor of variation in AVE, with an adjusted-r^2 of -0.314 (p=.000). The relationship between AVE and Percentage of Subsistence from Gathering was as predicted by the Economic Hypothesis. However, the lack of importance ascribed to Percentage of Subsistence from Fishing was not.

Figure 14 depicts the results of AVE plotted against the categorical variables Food Storage and Mobility. This figure suggested that hunter-gatherers with more complex food storage strategies have higher AVE. However, contrary to Figures 10 and 12, more sedentary groups did not have more complex clothing. This result is partially in line with the predictions made by the Economic Hypothesis.

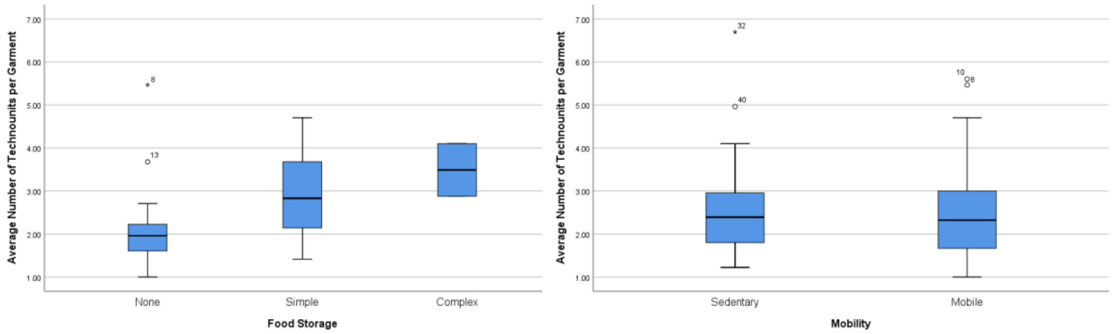

Figure 14: Box plots depicting the relationships between Average Number of Technounits and the categorical variables Food Storage and Mobility.

4.1.3.4. Maximum Number of Layers

Figure 15 depicts the relationships between the clothing variable MNL and the economic variables Percentage of Subsistence from Fishing, Percentage of Subsistence from Hunting, and Percentage of Subsistence from Gathering. MNL was negatively associated with Percentage of Subsistence from Gathering, but was positively associated with Percentage of Subsistence from Fishing. Percentage of Subsistence from Hunting has no directional association. These relationships are as predicted by the Economic Hypothesis.

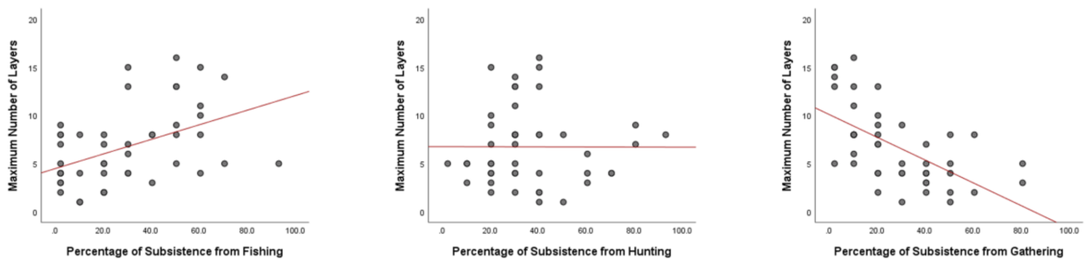

Figure 15: Scatter-plots showing the relationship between the clothing variable Maximum Number of Layers and the economic variables.

The results of the analyses in which MNL was regressed on the economic variables are summarised in Table 12. One of the three relationships was statistically significant (Percentage of Subsistence from Gathering).

*Table 12: Simple linear regression results for Maximum Number of Layers (MNL) and the economic variables. *Relationship is significant (2-tailed).*

	Percentage of Subsistence from Fishing	**Percentage of Subsistence from Hunting**	**Percentage of Subsistence from Gathering**
MNL	r^2=0.186 p=.002*	r^2=-0.023 p=.985	r^2=-0.343 p=.000*

The stepwise multiple regression analysis (multiple regression analysis) focused on MNL indicated that, in a one-variable model, Percentage of Subsistence from Gathering is the only important predictor of variation in MNL, with an adjusted-r^2 of -0.343 (p=.000). The relationship between Percentage of Subsistence from Gathering and MNL is as predicted by the Economic Hypothesis. However, the lack of importance ascribed to Percentage of Subsistence from Fishing was not.

Figure 16 depicts the relationships between MNL and the categorical variables Food Storage and Mobility. These results are in line with the predictions made by the Economic Hypothesis: hunter-gatherers with more complex food storage techniques and more sedentary groups will employ more layers of clothing.

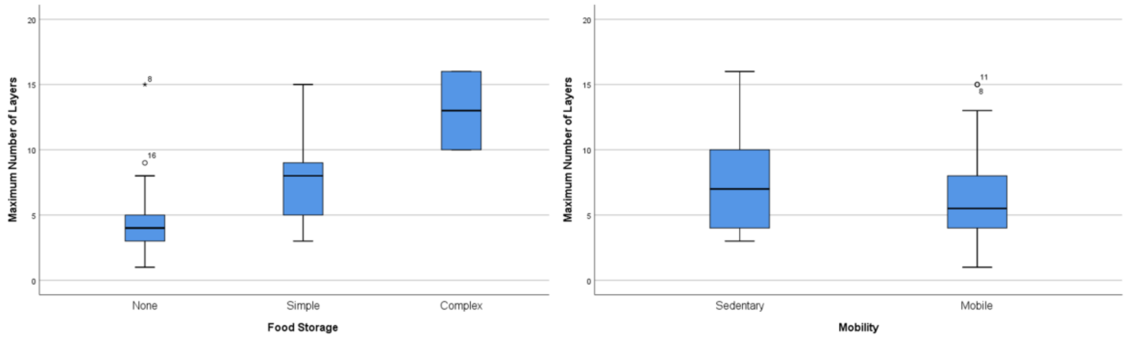

Figure 16: Box plots depicting the relationships between Maximum Number of Layers and the categorical variables Food Storage and Mobility.

4.1.3.5. Summary of tests of Economic Hypothesis using data for Whole Wardrobe

Across all four clothing variables, Percentage of Subsistence from Gathering was the most influential of the numerical economic variables. For each of the clothing variables, Percentage of Subsistence from Fishing appeared to be influential in the simple linear regressions, but was not retained in any of the stepwise multiple regression analysis, suggesting that it plays little role in predicting clothing variation. The gulf between the strength of associations that Percentage of Subsistence from Gathering has with TNG and its associations with TTS, AVE, and MNL suggested that hunter-gatherers relying more heavily on gathering tend to have less complex garments and employ fewer layers more consistently than they have less rich wardrobes in comparison to hunter-gatherers relying less on gathering. Of the categorical variables, both Food Storage and Mobility were associated with rich wardrobes, complex garments, and more layers. However, Mobility was not associated with a higher average complexity of garment, whereas Food Storage was positively associated with all four of TNG, TTS, AVE, and MNL.

4.1.4. Tests of the Social Hypothesis

4.1.4.1. Total Number of Garments

Figure 17 depicts the relationships between the clothing variable TNG and the independent social variables Sexual Dimorphism Index, Sexual Freedom Index-Male, and Sexual Freedom Index-Female. TNG was positively associated with Sexual Dimorphism Index, but was negatively associated with the latter two variables. The directions of association are as predicted by the Social Hypothesis: more sexually dimorphic hunter-gatherers should have more garments and sexually freer societies should have fewer.

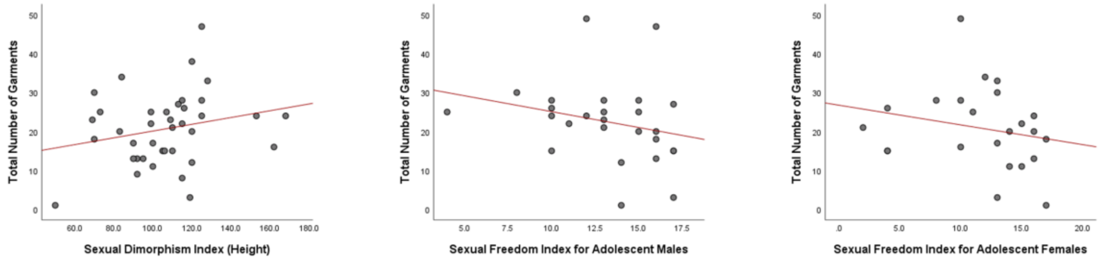

Figure 17: Scatter-plots showing the relationships between the clothing variable Total Number of Garments and each of the social variables.

The results of the analyses in which TNG was regressed on the social variables are summarised in Table 13. None of the relationships were statistically significant.

*Table 13: Simple linear regression results for Total Number of Garments (TNG) and the social variables. *Relationship is significant (2-tailed).*

	Sexual Dimorphism Index	**Sexual Freedom Index-Male**	**Sexual Freedom Index-Female**
TNG	r^2=0.027 p=.163	r^2=-0.024 p=.216	r^2=-0.002 p=.320

Figure 18 depicts TNG plotted against Outgroup Violence. The figure shows that groups that are more accepting of violence have a tendency to have more garments. This result is as predicted by the Social Hypothesis.

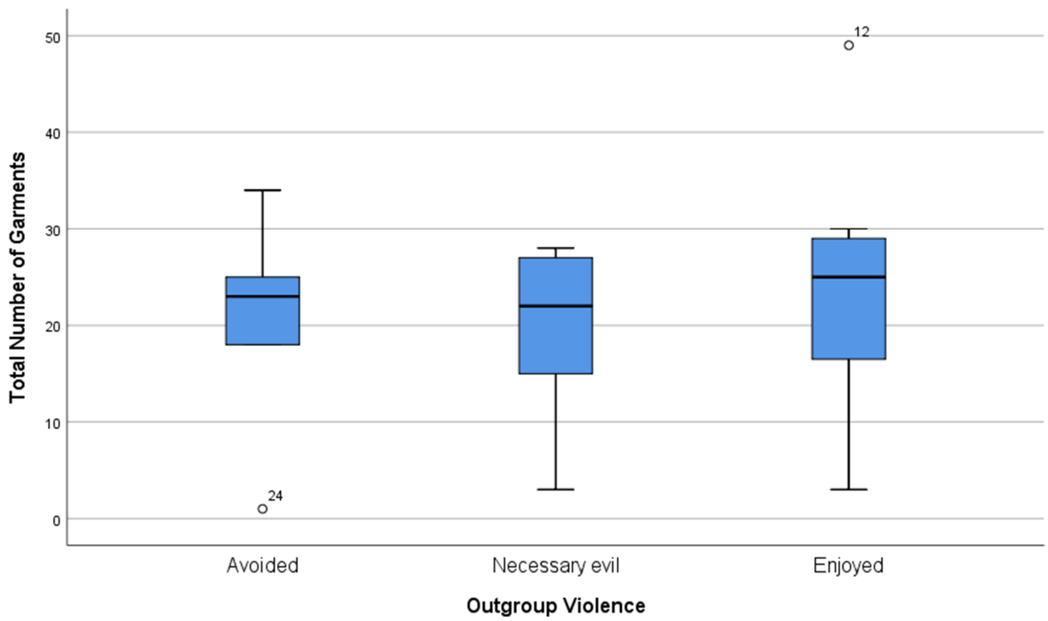

Figure 18: Box plot depicting the relationship between Total Number of Garments and the categorical variable Outgroup Violence.

4.1.4.2. Total Number of Technounits

Figure 19 depicts the relationships between the clothing variable TTS and the independent social Sexual Dimorphism Index, Sexual Freedom Index-Male, and Sexual Freedom Index-Female. TTS was positively associated with Sexual Dimorphism Index, but was negatively associated with the latter two variables. The directions of association are as predicted by the Social Hypothesis: more sexually dimorphic hunter-gatherers should have more clothing components and sexually freer societies should have fewer.

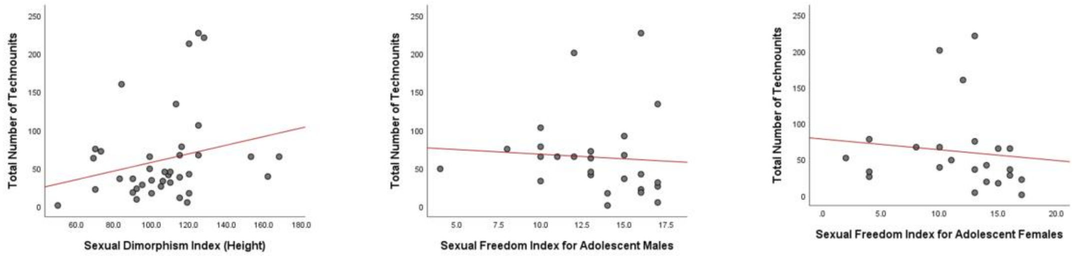

Figure 19: Scatter-plots showing the relationships between the clothing variable Total Number of Technounits and each of the social variables.

The results of the analyses in which TTS was regressed on the social variables are summarised in Table 14. None of the relationships were statistically significant.

*Table 14: Simple linear regression results for Total Number of Technounits (TTS) and the social variables. *Relationship is significant (2-tailed).*

	Sexual Dimorphism Index	Sexual Freedom Index-Male	Sexual Freedom Index-Female
TTS	r^2=0.032 p=.145	r^2=-0.036 p=.724	r^2=-0.033 p=.598

The results of analyses in which TTS is plotted against the categorical variable Outgroup Violence are presented in Figure 20. The results suggest more warlike societies have a tendency to have more TTS. This result is in line with the predictions made by the Social Hypothesis.

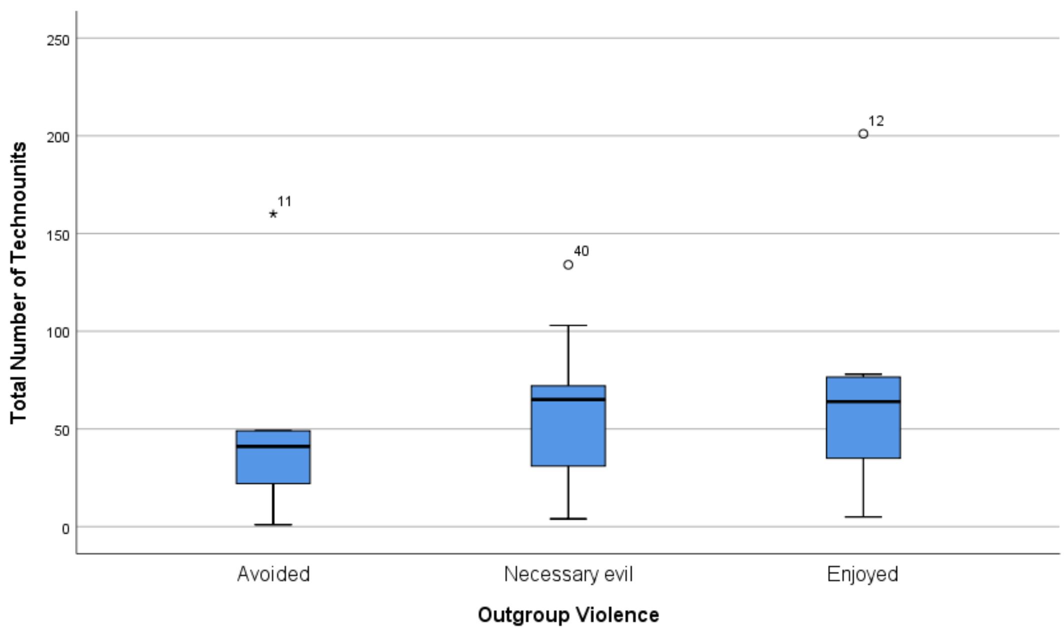

Figure 20: Box plot depicting the relationship between Total Number of Technounits and the categorical variable Outgroup Violence.

4.1.4.3. Average Number of Technounits per Garment

Figure 21 depicts the relationships between the clothing variable AVE and the independent social variables Sexual Dimorphism Index, Sexual Freedom Index-Male, and Sexual Freedom Index-Female. AVE was positively associated with Sexual Dimorphism Index, but was negatively associated with the latter two variables. The directions of association are as predicted by the Social Hypothesis: more sexually dimorphic hunter-gatherers should have more complex garments and sexually freer societies should have less complex ones.

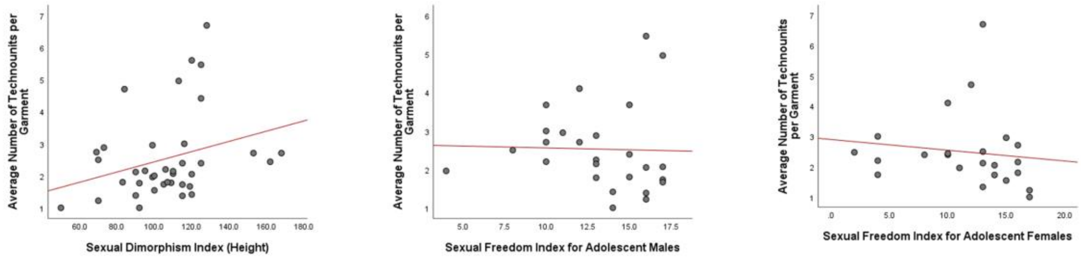

Figure 21: Scatter-plots showing the relationships between the clothing variable Average Number of Technounits per Garment and each of the social variables.

The results of the analyses in which AVE was regressed on the social variables are summarised in Table 15. None of the associations reached statistical significance. The stepwise multiple regression analysis focused on AVE indicated that, in a one-variable model, Sexual Dimorphism Index was the only important predictor of variation in AVE (adjusted-r^2 -0.328, p=.030). This result is as predicted by the Social Hypothesis, and contrasts with the result of the simple linear regression: more sexually dimorphic societies should have more complex garments.

*Table 15: Simple linear regression results for Average Number of Technounits per Garment (AVE) and the social variables. *Relationship is significant (2-tailed).*

	Sexual Dimorphism Index	Sexual Freedom Index-Male	Sexual Freedom Index-Female
AVE	r^2=0.059 p=.077	r^2=-0.041 p=.891	r^2=-0.031 p=.561

Figure 22 depicts AVE plotted against Outgroup Violence. The result suggests that more warlike societies tend to have higher average garment complexity. This result is as predicted by the Social Hypothesis.

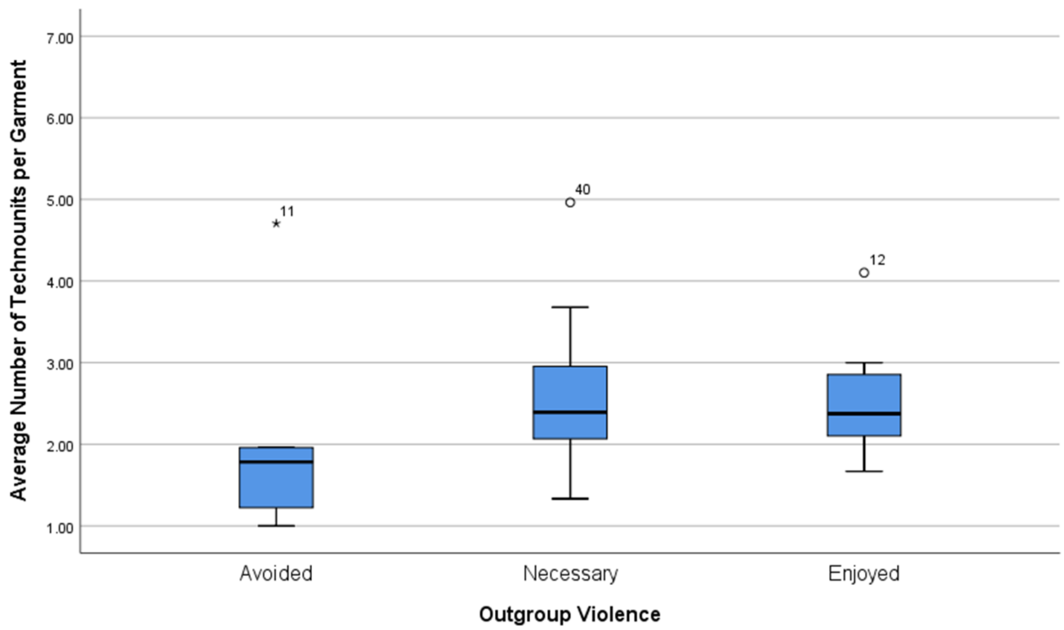

Figure 22: Box plot depicting the relationship between Average Number of Technounits per Garment and the categorical variable Outgroup Violence.

4.1.4.4. Maximum Number of Layers

Figure 23 depicts the relationships between the clothing variable MNL and the social variables Sexual Dimorphism Index, Sexual Freedom Index-Male, and Sexual Freedom Index-Female. MNL was positively associated with Sexual Dimorphism Index, but was negatively associated with the latter two variables. The directions of association are as predicted by the Social Hypothesis: more sexually dimorphic hunter-gatherers should have more layers and sexually freer societies should have fewer.

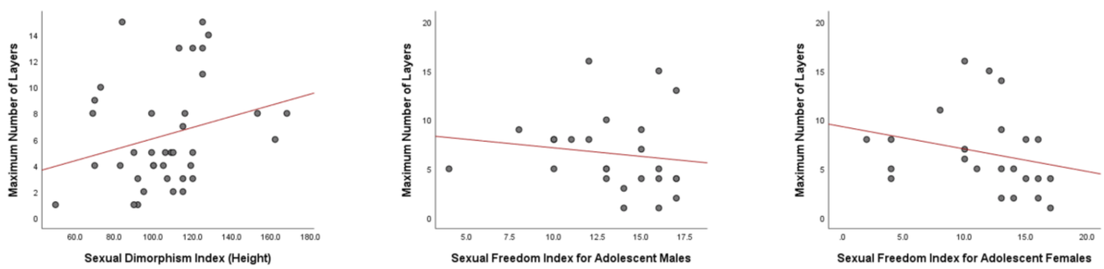

Figure 23: Scatter-plots showing the relationships between the clothing variable Maximum Number of Layers and each of the social variables.

The results of the analyses in which MNL was regressed on the social variables are summarised in Table 16. The direction of the relationships was as expected, but only Sexual Dimorphism Index reached statistical significance.

*Table 16: Simple linear regression results for Maximum Number of Layers (MNL) and the social variables. *Relationship is significant (2-tailed).*

	Sexual Dimorphism Index	Sexual Freedom Index-Male	Sexual Freedom Index-Female
MNL	r^2=0.068 p=.038*	r^2=-0.20 p=.479	r^2=-0.017 p=.253

Figure 24 depicts MNL plotted against Outgroup Violence. The result suggests that more warlike societies tend to employ more layers. This result is in line with the Social Hypothesis.

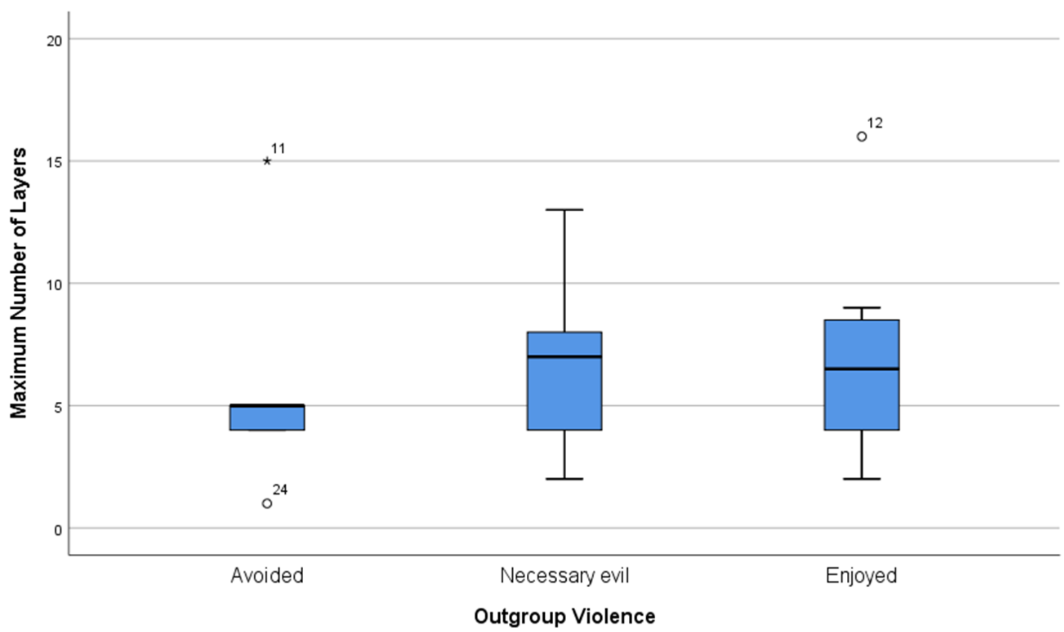

Figure 24: Box plot depicting the relationship between MNL and the categorical variable Outgroup Violence.

4.1.4.5. Summary of tests of the Social Hypothesis using data for Whole Wardrobe

Across the four clothing variables, Sexual Dimorphism Index was the most influential of the numerical social variables. However, it rarely reached statistical significance. It reached significance often enough to offer support for the Social Hypothesis (that more sexually dimorphic societies would have more complex clothing), but predicted the clothing variables weakly. The two Sexual Freedom Indices did not seem to be influential. The categorical variable Outgroup Violence proved to be strongly associated with higher TNG, TTS, AVE, and MNL. Therefore, the Social Hypothesis was again supported: more warlike societies tend to have richer wardrobes and more complex garments.

4.1.5. Tests of the Population Hypothesis

4.1.5.1. Total Number of Garments

Figure 25 depicts the relationships between the clothing variable TNG and the independent population variables Log10 Population Size, Log10 Population Density, and Maximum Aggregated Size. TNG was positively associated with Log10 Population Size and Maximum Aggregated Size, but was negatively associated with Log10 Population Density. Log10 Population Size and Maximum Aggregated Size were in the directions predicted by the Population Hypothesis. However, Log10 Population Density was not. While it was predicted that larger populations would have more garments, it was also predicted that denser populations would have more garments.

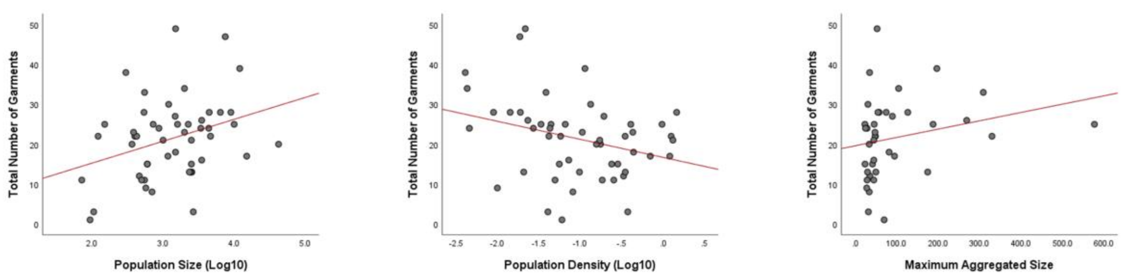

Figure 25: Scatter-plots showing the relationships between the clothing variable Total Number of Garments and each of the population variables.

The results of the analyses in which Total Number of Garments was regressed on the population variables are summarised in Table 17. Two of the three relationships were statistically significant (Log10 Population Size and Log10 Population Density).

*Table 17: Simple linear regression results for Total Number of Garments (TNG) and the population variables. *Relationship is significant (2-tailed).*

	Log10 Pop. Size	**Log10 Pop. Density**	**Maximum Aggregated Size**
TNG	r^2=0.090 p=.019	r^2=-0.073 p=.032	r^2=0.030 p=.150

The stepwise multiple regression analysis focused on TNG indicated that, in a one-variable model, Log10 Population Size was the only important predictor of variation in TNG, with an adjusted-r^2 of -0.090 (p=.019). That result is as predicted by the Population Hypothesis: wardrobe richness should increase with garment number.

4.1.5.2. Total Number of Technounits

Figure 26 depicts the relationships between the clothing variable TTS and the independent population variables Log10 Population Size, Log10 Population Density, and Maximum Aggregated Size. TTS was positively associated with Log10 Population Size and Maximum Aggregated Size, but was negatively associated with Log10 Population Density. Log10 Population Size and Maximum Aggregated Size were in the directions predicted by the Population Hypothesis. However, Log10 Population Density was not. While it was predicted that larger populations would have more technounits, it was also predicted that denser populations would have more technounits.

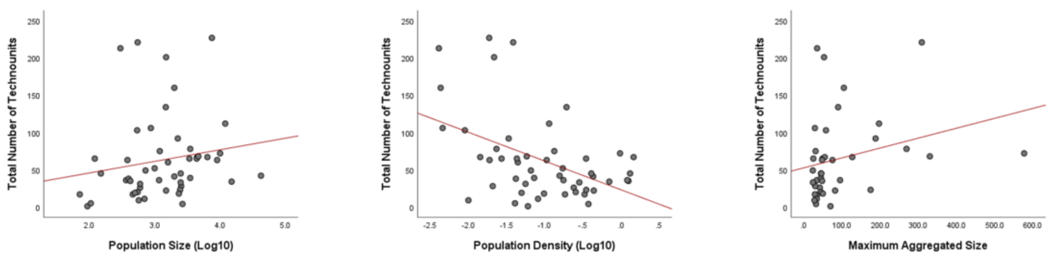

Figure 26: Scatter-plots showing the relationships between the clothing variable Total Number of Technounits and each of the population variables.

The results of the analyses in which TTS was regressed on the population variables are summarised in Table 18. One of the three relationships was statistically significant (Log10 Population Density).

*Table 18: Simple linear regression results for Total Number of Technounits (TTS) and the population variables. *Relationship is significant (2-tailed).*

	Log10 Pop. Size	Log10 Pop. Density	Maximum Aggregated Size
TTS	r^2=0.008 p=.247	r^2=-0.196 p=.001*	r^2=0.045 p=.104

The stepwise multiple regression analysis focused on TTS indicates that, in a one-variable model, Log10 Population Size was the strongest predictor of TTS variability, with an adjusted-r2 of 0.216 (p=.002), thus explaining 22% of the variation in TTS. This result was as predicted by the Population Hypothesis. Larger populations ought to have more technounits. In a second model, Maximum Aggregated Size was added, for an adjusted-r^2 of 0.304 (p=.001). This result was also as predicted by the Population Hypothesis. Hunter-gatherers aggregating together in larger numbers ought to have more technounits.

4.1.5.3. Average Number of Technounits per Garment

Figure 27 depicts the relationships between the clothing variable AVE and the independent population variables Log10 Population Size, Log10 Population Density, and Maximum Aggregated Size. AVE was positively associated with Log10 Population Size and Maximum Aggregated Size, but was negatively associated with Log10 Population Density. Log10 Population Size and Maximum Aggregated Size were in the directions predicted by the Population Hypothesis. However, Log10 Population Density was not. It was predicted that larger populations would have more complex clothing, it was also predicted that denser populations would have more complex clothing.

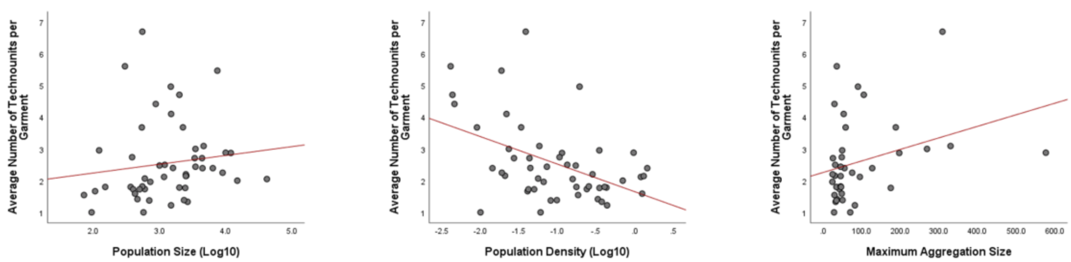

Figure 27: Scatter-plots showing the relationships between the clothing variable Average Number of Technounits per Garment and each of the population variables.

The results of the analyses in which AVE was regressed on the population variables are summarised in Table 19. One of the three relationships is statistically significant (Log10 Population Density).

*Table 19: Simple linear regression results for Average Number of Technounits per Garment (AVE) and the population variables. *Relationship is significant (2-tailed).*

	Log10 Pop. Size	**Log10 Pop. Density**	**Maximum Aggregated Size**
AVE	r^2=-0.003 p=.356	r^2=0.201 p=.001*	r^2=0.073 p=.054

The stepwise multiple regression analysis focused on AVE indicates that, in a one-variable model, Log10 Population Size was the only significant predictor of variability in AVE, with an adjusted-r^2 of .208 (p=.002), thus explaining 21% of AVE's variation. This result was as predicted by the Population Hypothesis: larger populations ought to be associated with more complex garments. A second model adds Maximum Aggregated Size for an adjusted-r^2 of 0.330 (p=.000). This result is also in line with the predictions made by the Population Hypothesis: hunter-gatherers aggregating in larger sizes ought to have more complex garments.

4.1.5.4. Maximum Number of Layers

Figure 28 depicts the relationships between the clothing variable MNL and the independent population variables Log10 Population Size, Log10 Population Density, and Maximum Aggregated Size. AVE was positively associated with Log10 Population Size and Maximum Aggregated Size, but was negatively associated with Log10 Population Density. Log10 Population Size and Maximum Aggregated Size were in the directions predicted by the Population Hypothesis. However, Log10 Population Density was not. It was predicted that larger populations would have more layers, it was also predicted that denser populations would have more layers.

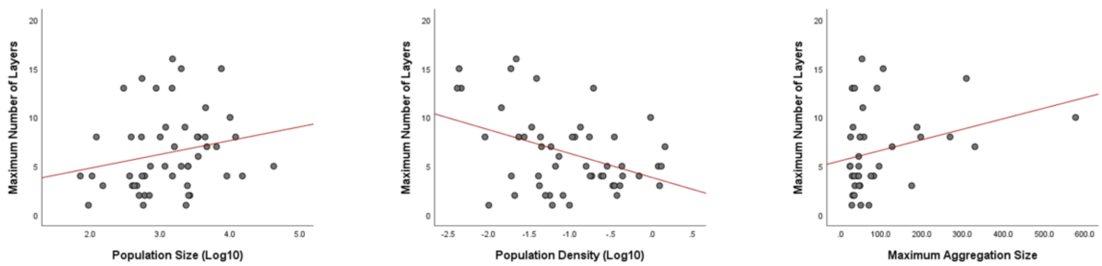

Figure 28: Scatter-plots showing the relationships between the clothing variable Maximum Number of Layers and each of the population variables.

The results of the analyses in which MNL was regressed on the population variables are summarised in Table 20. One of the three relationships is statistically significant (Log10 Population Density).

*Table 20: Simple linear regression results for Maximum Number of Layers (MNL) and the population variables. *Relationship is significant (2-tailed).*

	Log10 Pop. Size	Log10 Pop. Density	Maximum Aggregated Size
MNL	r^2=0.025 p=.141	r^2=-0.148 p=.003*	r^2=0.060 p=.062

The stepwise multiple regression analysis focused on MNL indicates that, in a one-variable model, Log10 Population Size was the only significant predictor of variability in MNL, with an adjusted-r^2 of 0.243 (p=.005), thus explaining 24% of MNL's variation. This result is as predicted by the Population Hypothesis: hunter-gatherers with larger population sizes ought to employ more layers.

4.1.5.5. Summary of test of the Population Hypothesis using data for Whole Wardrobe

With regard to the results focused on the Population Hypothesis, linear regression analyses suggested support for Log10 Population Density being the only variable that was consistently and significantly influential on the clothing variables. However, the stepwise multiple regression analysis consistently retained the other two variables, both related to population size: Log10 Population Size and Maximum Aggregated Size. The inconsistency between the linear and stepwise multiple regression analysis suggested that the linear results were capturing population-size related data due to there being a positive association between population size and population density. Therefore, the results offer support for the Population Hypothesis: larger populations tend to have more TNG, TTS, higher AVE, and more MNL.

4.2. INTER-SEXUAL DIFFERENCES IN CLOTHING

In analysing clothing data categorised by the sex of the garment wearer, my goal was to show differences in the characteristics of clothing worn by either men or women, and whether men and women's clothing choices are affected by different variables. While this section presents the results of testing the Environmental, Economic, and Social Hypotheses, variables related to the Population Hypothesis were not used due to the lack of theoretical reason why they should predict differences in men's and women's clothing.

4.2.1. Descriptive statistics for, and relationships among, the clothing variables

The descriptive statistics for the clothing data demarcated by the sex of the wearer are presented below (Table 21). Male TNG ranges number between zero and 18 with a mean of 7.62. Female TNG ranges between zero and 14 with a mean of 4.94. Male TTS ranges in number between zero and 128 with a mean of 23.6. Female TTS ranges between zero and 70 with a mean value of 16. Male AVE ranges between zero and 7.11 with a mean of 2.6, and Female AVE ranges between zero and 7.75 with a mean of 2.6. All standard deviations are relatively small except for that of Male AVE which has a standard deviation of 26.7, exceeding the mean of the same variable. The variable's high standard deviation, especially relative to that of Female AVE, suggests a very large worldwide range of Male AVE.

Table 21: Descriptive statistics for the six main clothing variables when broken down by the sex of the wearer.

Clothing variable	Minimum	Maximum	Mean	Std. Deviation
Male TNG	0	18	7.62	4.94
Female TNG	0	14	4.94	3.36
Male TTS	.00	128	23.58	26.65
Female TTS	.00	70	16	17.45
Male AVE	.00	7.11	2.62	1.605
Female AVE	.00	7.75	2.55	1.79

The majority of the clothing variables correlate both positively and strongly with one another (Table 22). As with the correlations between variables in Whole Wardrobe and Decorative versus Non-Decorative Clothing, the garment variables correlated much more closely with one another than they did with the technounit and average technounit ones. And although Decorative versus Non-Decorative Clothing variables tended to sharply contrast one another, Male vs. Female Clothing variables correlate more strongly with each other. Each correlation was statistically significant.

*Table 22: Relationships between the six clothing variables when the wardrobe is demarcated by sex of the wearer. ** Relationship is statistically significant (2-tailed).*

	Female TNG	**Male TTS**	**Female TTS**	**Male AVE**	**Female AVE**
Male TNG	r^2=0.436** p=.001	r^2=0.819** p=.000	r^2=0.643** p=.000	r^2=0.465** p=.001	r^2=0.695** p=.000
Female TNG	-	r^2=0.476** p=.000	r^2=0.786** p=.000	r^2=0.454** p=.001	r^2=0.577** p=.000
Male TTS		-	r^2=0.858** p=.000	r^2=0.765** p=.000	r^2=0.880** p=.000
Female TTS			-	r^2=0.713** p=.000	r^2=0.861** p=.000
Male AVE				-	r^2=0.760** p=.000

4.2.2. Tests of the Environmental Hypothesis

4.2.2.1. Total Number of Garments

Figure 29 depicts the relationships between both Male and Female TNG and Average Annual Temperature, Average Wind Chill, and Peak Wind Chill. Male TNG was negatively associated with Average Annual Temperature, Average Wind Chill, and Peak Wind Chill. Female TNG was negatively associated with those three environmental variables as well. Both Male and Female TNGs are negatively associated with Average Relative Humidity, Average Yearly Precipitation, and Average Yearly Snowfall (Figure 30). All of the directions of association are as predicted by the Environmental Hypothesis, with the exception of both Male and Female TNG's associations with Average Yearly Precipitation, which was predicted to have a positive association with all TNG.

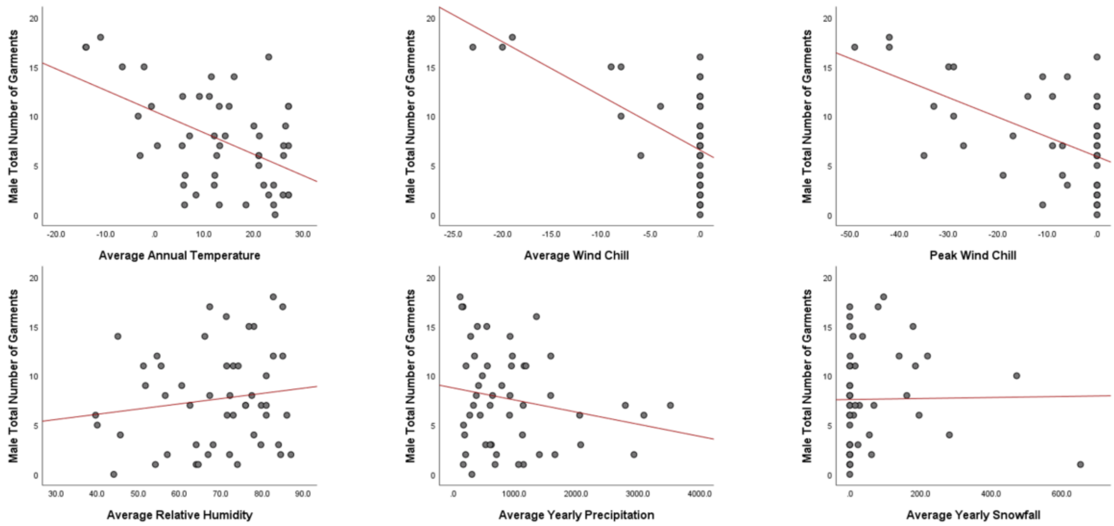

Figure 29: Top row: Scatter-plots showing the relationships between Male Total Number of Garments and its associations with the temperature-related variables. Bottom row: Scatter-plots showing the relationships between the clothing variable Female Total Number of Garments and the same three variables.

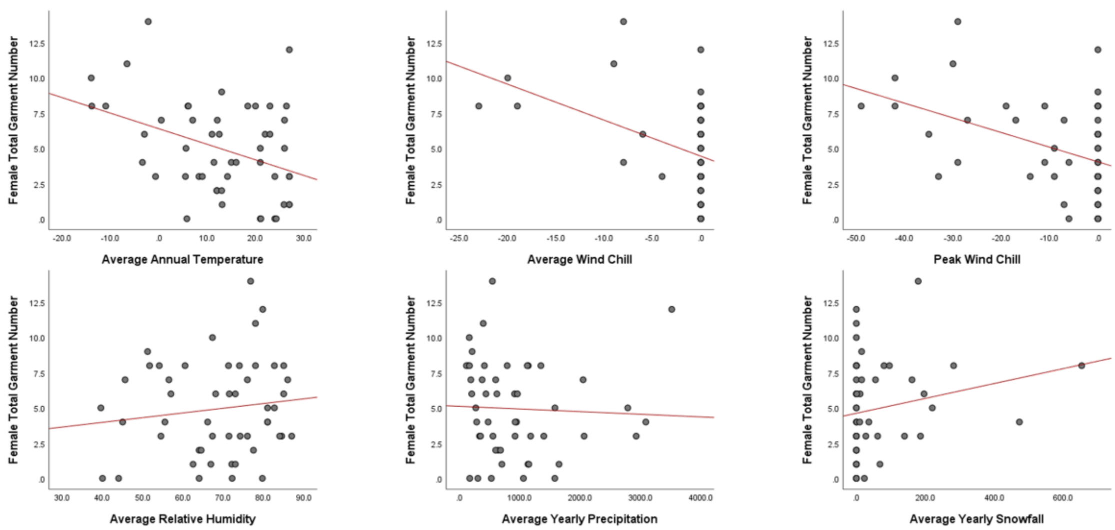

Figure 30: Top row: Scatter-plots showing the relationships between Female Total Number of Garments with the precipitation-related environmental variables. Bottom row: Scatter-plots showing the relationships between Female Total Number of Garments and the same three variables.

The results of the analyses in which both Male TNG and Female TNG were regressed on the environmental variables are summarised in Table 23. For Male TNG, three of the six relationships were statistically significant. The three significant relationships were with Average Annual Temperature, Average Wind Chill, and Peak Wind Chill. For Female TNG, the same three relationships were statistically. Given that the Male vs. Female facets of the Environmental Hypothesis are often to do with degrees of association between either sex's variables rather than their directions of association, it is notable that the results were as predicted by the Environmental Hypothesis. Male TNG was more strongly associated with the significant environmental variables than Female TNG due to men's participation in riskier subsistence activities.

*Table 23: Simple linear regression results for Male TNG, Female TNG, and the environmental variables. *Relationship is significant (2-tailed).*

	Average Annual Temperature	Average Wind Chill	Peak Wind Chill	Average Relative Humidity	Average Yearly Precipitation	Average Yearly Snowfall
Male TNG	r^2=-0.241 p=.000*	r^2=-0.311 p=.000*	r^2=-0.294 p=.000*	r^2=0.001 p=.333	r^2=-0.021 p=.159	r^2=0.021 p=.928
Female TNG	r^2=-0.126 p=.007*	r^2=-0.143 p=.004*	r^2=-0.164 p=.002*	r^2=0.004 p=.369	r^2=-0.019 p=.754	r^2=0.019 p=.167

The stepwise multiple regression analysis focused on the Male TNG indicated that Average Wind Chill was the only significant correlating variable in a one-model result (adjusted-r^2 -0.331, p=.000). The multiple regression analysis focused on Female TNG yielded a different result. That multiple regression analysis suggested that Peak Wind Chill the strongest predictor of Female TNG (adjusted-r^2 -0.164, p=.002). That result is as predicted by the Environmental Hypothesis: Male TNG should be more strongly associated with environmental variables than Female TNG due to men's participation in riskier subsistence activities.

4.2.2.2. Total Number of Technounits

Figure 31 depicts the relationships between both Male and Female TTS and the environmental variables Average Annual Temperature, Average Wind Chill, and Peak Wind Chill. Male TTS was negatively associated with Average Annual Temperature, Average Wind Chill, and Peak Wind Chill. Female TTS was negatively associated with the three environmental variables as well. The strength of associations between the independent clothing variables and either sex's variables were roughly equivalent. Figure 32 depicts both Male TNG and Female TTS and their relationships to the environmental variables Average Relative Humidity, Average Yearly Precipitation, and Average Yearly Snowfall. Male TTS was positively associated with Average Relative Humidity, Average Yearly Precipitation, and Average Yearly Snowfall. Female TTS displays the same pattern of associations at roughly the same strength of association.

All of the directions of association are as predicted by the Environmental Hypothesis, with the exception of both Male and Female TTS's associations with Average Yearly Precipitation, which was predicted to have a positive association with all TTS.

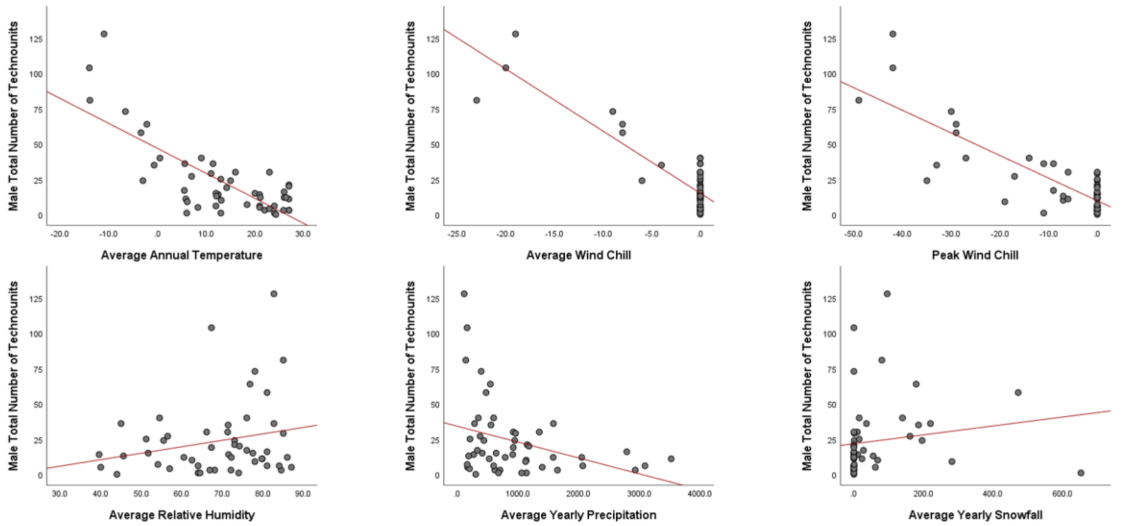

Figure 31: Top row: Scatter-plots showing the relationships between Male Total Number of Technounits and the temperature-related environmental variables. Bottom row: Scatter-plots showing the relationships between the clothing variable Female Total Number of Technounits and the same three variables.

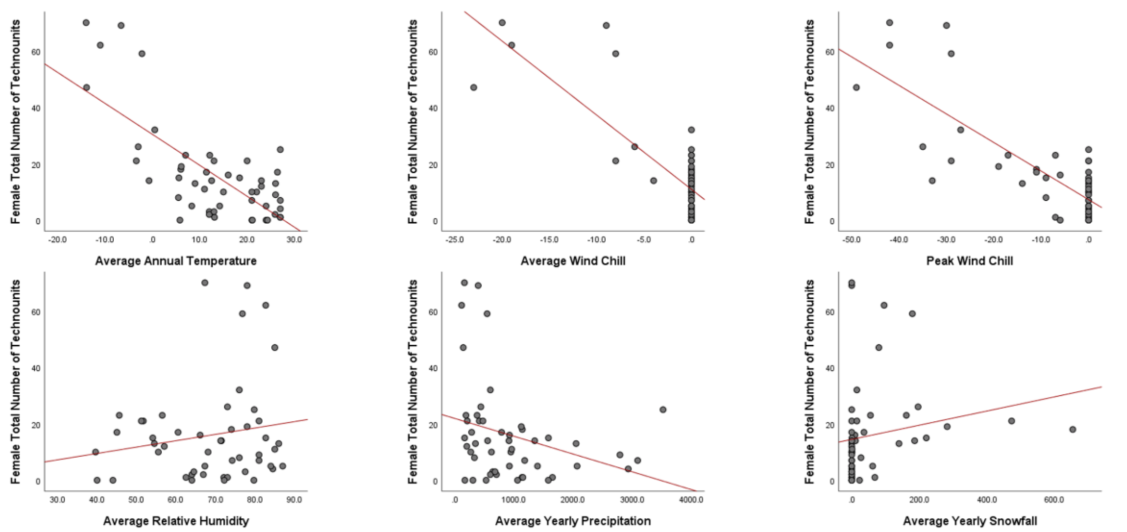

Figure 32: Top row: Scatter-plots showing the relationships between the clothing variable Female Total Number of Technounits and the precipitation-related environmental variables. Bottom row: Scatter-plots showing the relationships between Female Total Number of Technounits and the same three variables.

The results of the analyses in which both Male TTS and Female TTS were regressed on the environmental variables are summarised in Table 24. For Male TTS, four of the six relationships were statistically significant. These significant relationships are with Average Annual Temperature, Average Wind Chill, Peak Wind Chill, and Average Yearly Precipitation. For Female TTS, four of the six relationships were statistically significant, and they are the same four as with the men's. The results offered slight support for the Environmental Hypothesis that Male TTS would be more strongly associated with environmental variables than Female TTS due to men's participation in riskier subsistence activities.

*Table 24: Simple linear regression results for Male TTS, Female TTS, and the environmental variables. *Relationship is significant (2-tailed).*

	Average Annual Temperature	Average Wind Chill	Peak Wind Chill	Average Relative Humidity	Average Yearly Precipitation	Average Yearly Snowfall
Male TTS	r^2=-0.580 p=.000*	r^2=-0.756 p=.000*	r^2=-0.676 p=.002*	r^2=0.030 p=.118	r^2=-0.099 p=.015*	r^2=0.002 p=.301
Female TTS	r^2=-0.516 p=.000*	r^2=-.622 p=.000*	r^2=-0.626 p=.000*	r^2=0.008 p=.242	r^2=-0.067 p=.039*	r^2=0.013 p=.207

The stepwise multiple regression analysis focused on the Male TTS yields two models. In the first, Average Wind Chill was retained (adjusted-r^2 -0.756, p=.000). In the second model, Average Annual Temperature was added, and Average Wind Chill+Average Annual Temperature had a combined adjusted-r^2 of -0.784 (p=.000). The multiple regression analysis focused on the Female TTS also yielded two models. In the first model, Peak Wind Chill was retained (adjusted-r^2 -0.626, p=.000). In the second model, Average Wind Chill was added (adjusted-r^2 -0.671, p=.000). These results were as predicted by the Environmental Hypothesis, which predicted that Male TTS would be more strongly associated with Female TTS due to male participation in riskier subsistence activities.

4.2.2.3. Average Number of Technounits per Garment

Figure 33 depicts the relationships between both Male AVE and Female AVE and the environmental variables Average Annual Temperature, Average Wind Chill, and Peak Wind Chill. Male AVE was negatively associated with each of Average Annual Temperature, Average Wind Chill, and Peak Wind Chill. Figure 34 depicts both Male AVE and Female AVE and their relationships to the environmental variables Average Relative Humidity, Average Yearly Precipitation, and Average Yearly Snowfall. Male

AVE was positively associated with Average Relative Humidity and Average Yearly Snowfall, and negatively associated with Average Yearly Precipitation. Female AVE displayed the same pattern of associations. All of the directions of association are as predicted by the Environmental Hypothesis, with the exception of both Male and Female AVE's associations with Average Yearly Precipitation, which was predicted to have a positive association with all AVE.

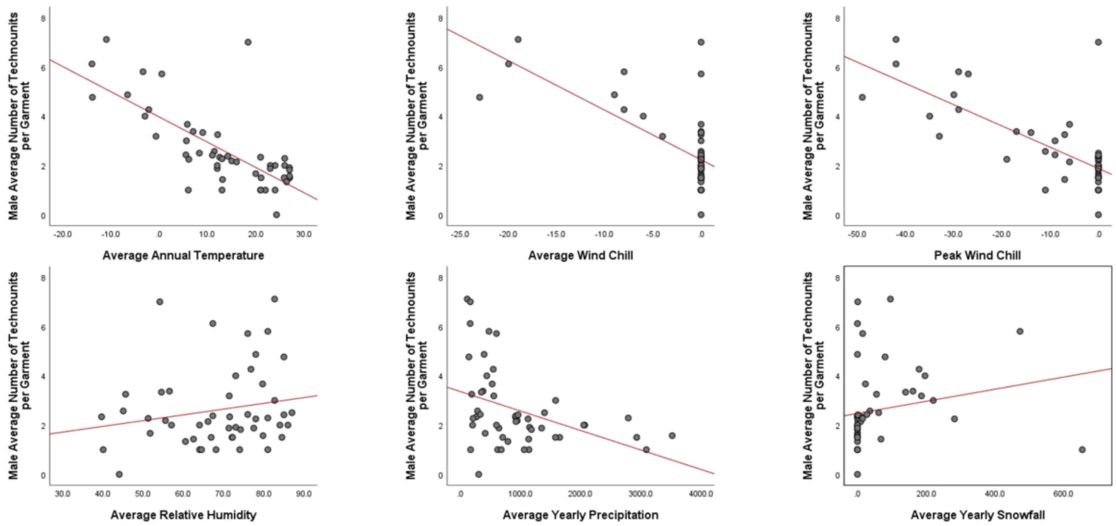

Figure 33: Male Average Number of Technounits per Garment and its associations with the temperature-related environmental variables. Bottom row: Female Average Number of Technounits per Garment and its associations with the same three variables.

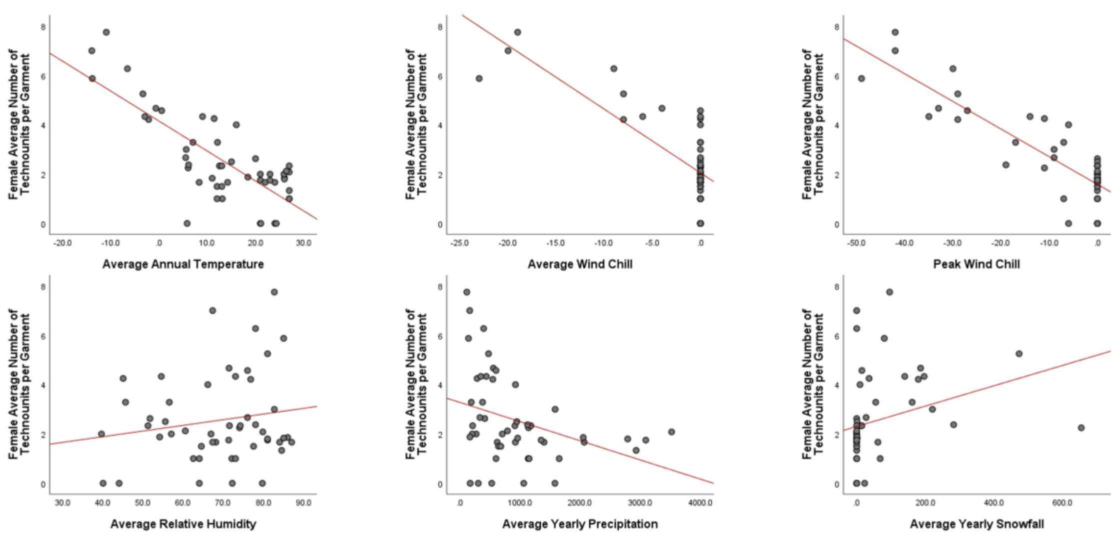

Figure 34: Top row: Scatter-plots Female Average Number of Technounits per Garment and its associations with the and the precipitation-related environmental variables. Bottom row: Female Average Number of Technounits per Garment and its associations with the same three variables.

The results of the analyses in which both Male AVE and Female AVE are regressed against the six environmental variables are summarised in Table 25. For Male AVE, four of the six relationships were statistically significant. The significant relationships were with Average Annual Temperature, Average Wind Chill, Peak Wind Chill, and Average Yearly Precipitation. For Female AVE, five of the six relationships were statistically significant. These are the ones involving Average Annual Temperature, Average Wind Chill, Peak Wind Chill, Average Yearly Precipitation, and Average Yearly Snowfall. The results did not support the Environmental Hypothesis that Male AVE would be more strongly associated with environmental variables than Female AVE due to men's participation in riskier subsistence activities. Female AVE was much more strongly associated with Peak Wind Chill than Male AVE. A similar pattern was notable for Average Annual Temperature and Average Wind Chill, though to a lesser degree.

*Table 25: Simple linear regression results for Male AVE, Female AVE, and the environmental variables. *Relationship is significant (2-tailed).*

	Average Annual Temperature	**Average Wind Chill**	**Peak Wind Chill**	**Average Relative Humidity**	**Average Yearly Precipitation**	**Average Yearly Snowfall**
Male AVE	r^2=-0.531 p=.000*	r^2=-0.425 p=.000*	r^2=-0.535 p=.002*	r^2=0.016 p=.188	r^2=-0.142 p=.004*	r^2=0.013 p=.207
Female AVE	r^2=-0.603 p=.000*	r^2=-0.570 p=.000*	r^2=-0.734 p=.000*	r^2=0.008 p=.246	r^2=-0.106 p=.012*	r^2=0.066 p=.040*

The multiple regression analysis focused on the Male AVE and Female AVE indicates that Peak Wind Chill was the only significant correlating variable for both Male AVE (adjusted-r2 -0.535, p=.000) and for Female AVE (adjusted-r2 -0.734, p=.000). These results were not as predicted by the Environmental Hypothesis. That hypothesis suggested that Male AVE would be more strongly associated with environmental variables.

4.2.2.4. Summary of tests of Environmental Hypothesis using sex differences in clothing use

While the results supported the overall Environmental Hypothesis' theses that temperature-related variables would play a much larger role in influencing clothing design than precipitation-related variables would, some of the results are contradictory with regard to the men's vs. women's clothing aspect of the hypothesis. The results suggested some support for men's clothing being more strongly associated with environmental variables related to temperature. However, AVE went against the trend set by TNG and TTS. Furthermore, the results suggested a dominant role for Peak Wind Chill in influencing both sex's wardrobes, and a nearly-equally important role for Average Annual Temperature.

4.2.3. Tests of the Economic Hypothesis

4.2.3.1. Total Number of Garments

Figure 35 depicts the relationships between both Male AVE and Female AVE and the economic variables Percentage of Subsistence from Fishing, Percentage of Subsistence from Hunting, and Percentage of Subsistence from Gathering. Male AVE was positively associated with Percentage of Subsistence from Fishing and Percentage of Subsistence from Hunting but was negatively associated with Percentage of Subsistence from Gathering. These results are as predicted by the Economic Hypothesis. Female AVE was positively associated with Percentage of Subsistence from Fishing but negatively associated with the remaining two. These results are mostly as predicted by the Economic Hypothesis, with the exception of Percentage of Subsistence from Hunting, which was predicted to be positively associated with TNG.

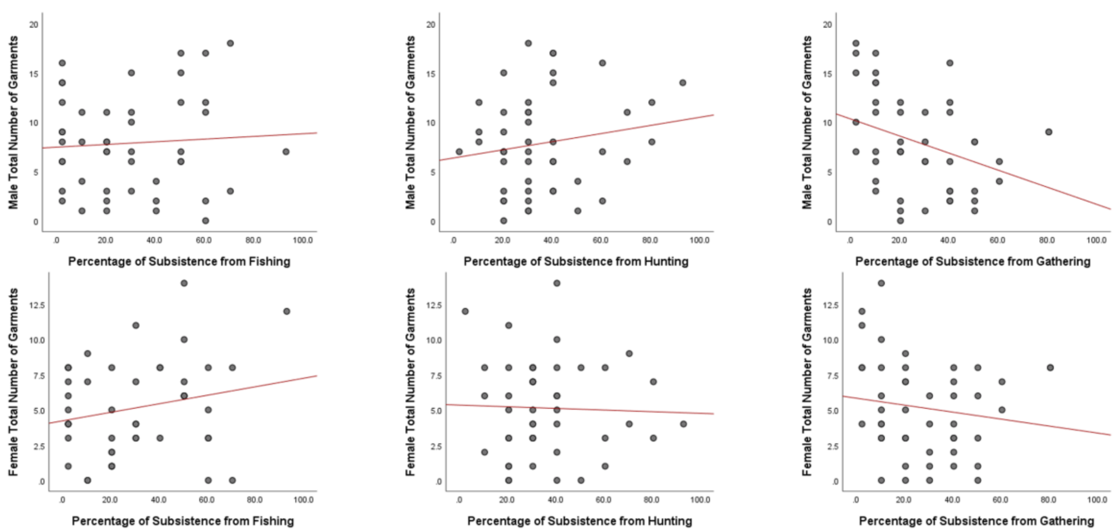

Figure 35: Top row: Scatter-plots showing the relationships between Male Total Number of Garments and its associations with the economic variables. Bottom row: Scatter-plots showing Female Total Number of Garments and its associations with the same three variables.

The results of the analyses in which both Male TNG and Female TNG were regressed against the economic variables are summarised in Table 26. For Male TNG, only the association with Percentage of Subsistence from Gathering was statistically significant. For Female TNG, none of the three relationships were statistically significant. Given that the Male vs. Female facets of the Economic Hypothesis are often to do with degrees of association between either sex's variables rather than their directions of association, it is notable that the results were as predicted by the Economic Hypothesis. Female TNG was more strongly associated with the only economic variable to reach statistical significance: Percentage of Subsistence from Gathering.

*Table 26: Simple linear regression results for Male Total Number of Garments (Male TNG), Female Total Number of Garments (Female TNG), and the economic variables. *Relationship is significant (2-tailed).*

	Percentage of Subsistence from Fishing	**Percentage of Subsistence from Hunting**	**Percentage of Subsistence from Gathering**
Male TNG	r^2=0.018 p=.665	r^2=0.006 p=.268	r^2=-0.106 p=.016*
Female TNG	r^2=0.045 p=.156	r^2=0.006 p=.268	r^2=-0.000 p=.327

The stepwise multiple regression analysis focused on the Male TNG indicated that Percentage of Subsistence from Gathering was the only significant predictor of variation of Male TNG (adjusted-r2 -0.106, p=.016). Percentage of Subsistence from Gathering therefore accounted for 10.6% of its variation. This result was as predicted by the Economic Hypothesis. However, since Male TNG was not able to be tested in a stepwise multiple regression analysis due to the independent variables not reaching the threshold for significance, its comparative value is limited.

4.2.3.2. Total Number of Technounits

Figure 36 depicts the relationships between both Male TTS and Female TTS and the economic variables Percentage of Subsistence from Fishing, Percentage of Subsistence from Hunting, and Percentage of Subsistence from Gathering. Male TTS was positively associated with Percentage of Subsistence from Fishing, negatively associated with Percentage of Subsistence from Gathering, and its association with Percentage of Subsistence from Hunting returned an error. Female Total Number of Technounits had the same pattern of relationships. These results are as predicted by the Economic

Hypothesis, which predicts that cultures relying more heavily on fishing would have more technounits and those relying more heavily on gathering would have fewer.

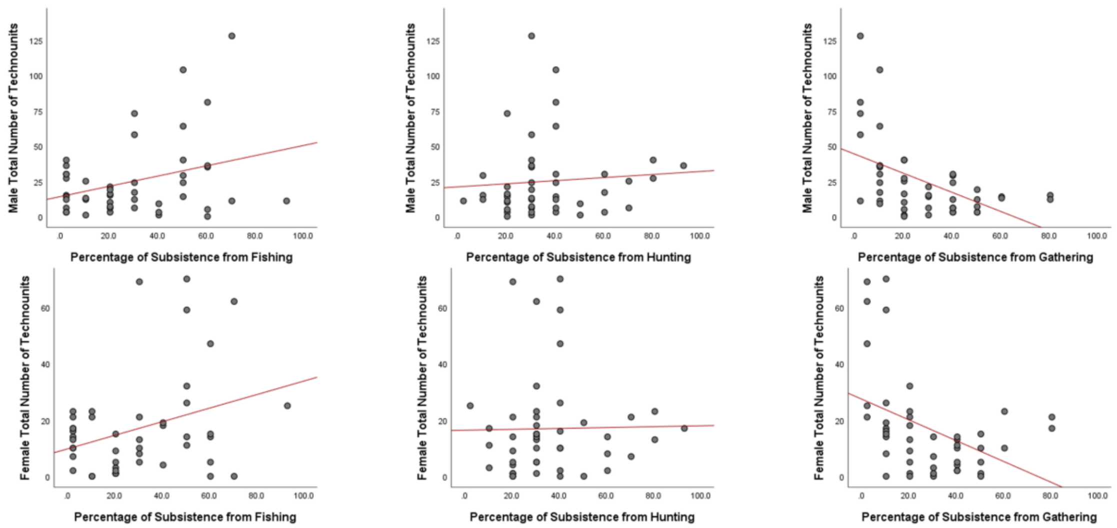

Figure 36: Top row: Scatter-plots showing the relationships between Male Total Number of Technounits and its associations with the subsistence variables. Bottom row: Scatter-plots showing Female Total Number of Technounits and its associations with the same three variables.

For Male TTS, two of the three relationships were statistically significant (Table 27). Those two were Percentage of Subsistence from Fishing and Percentage of Subsistence from Gathering. Female TTS displayed the same pattern, with Percentage of Subsistence from Fishing and Percentage of Subsistence from Gathering. The results were not as predicted by the Economic Hypothesis. Female TNG was, in fact, less strongly associated with the only economic variable to reach statistical significance: Percentage of Subsistence from Gathering.

*Table 27: Simple linear regression results for Male Total Number of Technounits (Male TTS), Female Total Number of Technounits (Female TTS), and the economic variables. *Relationship is significant (2-tailed).*

	Percentage of Subsistence from Fishing	**Percentage of Subsistence from Hunting**	**Percentage of Subsistence from Gathering**
Male TTS	r^2=0.079 p=.033	r^2=0.016 p=.597	r^2=-0.234 p=.000
Female TTS	r^2=0.082 p=.030	r^2=0.022 p=.909	r^2=-0.173 p=.004

The stepwise multiple regression analysis focused on the Male TTS indicates that Percentage of Subsistence from Gathering was the only significant predictor of variation in Male TTS (adjusted-r2 0.234, p=.000). The multiple regression analysis focused Female TTS indicates a similar relationship with Percentage of Subsistence from Gathering (adjusted-r2 0.154, p=.004). These results were not as predicted by the Economic Hypothesis. Again, Female TNG was less strongly associated with the only economic variable be retained by stepwise multiple regression analysis: Percentage of Subsistence from Gathering.

4.2.3.3. Average Number of Technounits per Garment

Figure 37 depicts the relationships between both Male AVE and Female AVE and the environmental variables Percentage of Subsistence from Fishing, Percentage of Subsistence from Hunting, and Percentage of Subsistence from Gathering. Male AVE was positively associated with Percentage of Subsistence from Fishing and negatively associated with Percentage of Subsistence from Hunting and Percentage of Subsistence from Gathering. Female AVE was positively associated with Percentage of Subsistence from Fishing and Percentage of Subsistence from Hunting and negatively associated with Percentage of Subsistence from Gathering. These results are as predicted by the Economic Hypothesis, which predicts that cultures relying more heavily on fishing would have more complex garments and those relying more heavily on gathering would have less complex garments.

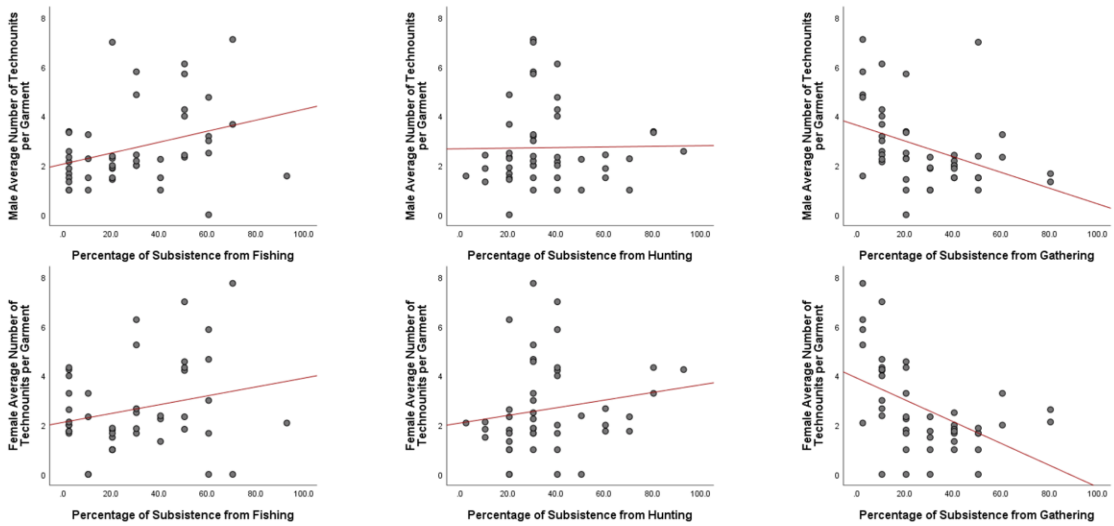

Figure 37: Scatter-plots showing Male AVE and its associations with the subsistence variables. Bottom row: Female AVE and its associations with the same three variables.

The results of the analyses in which Male AVE and Female AVE were regressed against the subsistence variables are summarised in Table 28. For Male AVE, the relationships with Percentage of Subsistence from Fishing and Percentage of Subsistence from Gathering were statistically significant. For Female AVE, only its relationship with Percentage of Subsistence from Gathering was statistically significant. It is notable that the degree of association that either sex's AVE has with Percentage of Subsistence from Gathering was inverted from the TTS result discussed in Chapter 5.2.3.2. Therefore, this result supported the Economic Hypothesis that predicted stronger associations between Female AVE and Percentage of Subsistence from Gathering compared to Male AVE and the same economic variable.

*Table 28: Simple linear regression results for Male Average Number of Technounits per Garment (Male AVE), Female Average Number of Technounits per Garment (Female AVE), and the economic variables. *Relationship is significant (2-tailed).*

	Percentage of Subsistence from Fishing	**Percentage of Subsistence from Hunting**	**Percentage of Subsistence from Gathering**
Male AVE	r^2=0.084 p=.028	r^2=-0.022 p=.929	r^2=0.136 p=.007
Female AVE	r^2=0.033 p=.117	r^2=0.007 p=.259	r^2=0.223 p=.001

The stepwise multiple regression analysis focused on the Male AVE indicated that Percentage of Subsistence from Gathering was the only significant predictor of the three subsistence variables for variation in average decorative technounit number (adjusted-r^2 0.136, p=.007). The multiple regression analysis focused on Female AVE found that Percentage of Subsistence from Gathering was also the strongest predictor (adjusted-r2 0.223, p=.001). These results were as predicted by the Economic Hypothesis. Female TNG was more strongly associated with the only economic variable be retained by stepwise multiple regression analysis: Percentage of Subsistence from Gathering.

4.2.3.4. Summary of tests of the Economic Hypothesis using sex differences in clothing use

The only predictor variable that was frequently found to be statistically significant in its relationships with the clothing variables (Percentage of Subsistence from Gathering) suggested some support for the hypothesis that gathering, being more often an activity done by women, would be, as predicted by the Economic Hypothesis, more strongly associated with women's clothing variables. However, that pattern only held true for Female TNG and AVE, whereas the relationship was inverted for Male and Female TTS and their association with Percentage of Subsistence from Gathering. While simple linear regression suggested a role for Percentage of Subsistence from Fishing in shaping Male and Female clothing, it not being retained in stepwise multiple regression analysis suggests that it plays little role in influencing clothing at all.

4.2.4. Tests of the Social Hypothesis

4.2.4.1. Total Number of Garments

Figure 38 depicts the relationships between the clothing variables Male TNG and Female TNG and the social variables Sexual Dimorphism Index, Sexual Freedom Index-Male, and Sexual Freedom Index-Female. Male TNG was positively associated with Sexual Dimorphism Index and was negatively associated with Sexual Freedom Index-Male and Sexual Freedom Index-Female. Female TNG was positively associated with Sexual Dimorphism Index, and was negatively associated with Sexual Freedom Index-Male and Sexual Freedom Index-Female. These relationships are partially as predicted by the Social Hypothesis. While Sexual Dimorphism Index was predicted to be positively associated with Male and Female TNG (and Male TNG to a stronger degree), both

Sexual Freedom Indices did not conform to the prediction that sexually freer societies would employ fewer garments.

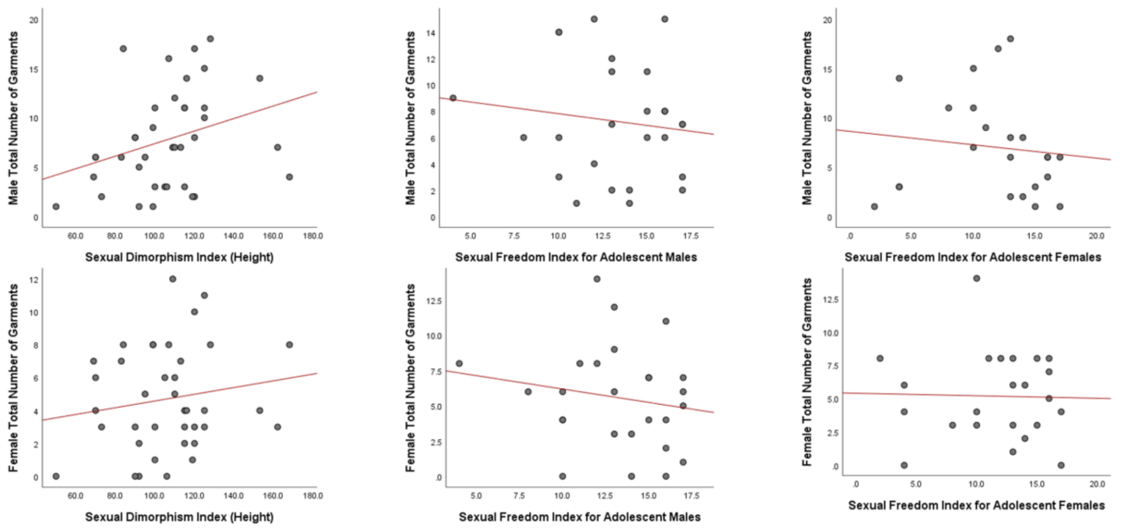

Figure 38: Top row: Scatter-plots showing the relationships between Male Total Number of Garments and the social variables. Bottom row: Scatter-plots showing the relationships between Female Total Number of Garments and the same three variables.

The results of the analyses in which both Male TNG and Female TNG were regressed on the social variables Sexual Dimorphism Index, Sexual Freedom Index-Male, and Sexual Freedom Index-Female are summarised in Table 29. For both versions of the clothing variable, no result was statistically significant.

*Table 29: Simple linear regression results for Male Total Number of Garments (Male TNG), Female Total Number of Garments (Female TNG), and the social variables. *Relationship is significant (2-tailed).*

	Sexual Dimorphism Index	**Sexual Freedom Index-Male**	**Sexual Freedom Index-Female**
Male TNG	r^2=0.074 p=.055	r^2=-0.024 p=.523	r^2=-0.033 p=.591
Female TNG	r^2=0.002 p=.339	r^2=-0.012 p=.409	r^2=-0.047 p=.906

4.2.4.2. Total Number of Technounits

Figure 39 depicts the relationships between both Male TTS and Female TTS and social variables Sexual Dimorphism Index, Sexual Freedom Index-Male, and Sexual Freedom Index-Female. Male TTS was positively associated with Sexual Dimorphism Index, was negatively associated with Sexual Freedom Index-Female, and returned an error for its association with Sexual Freedom Index-Male. Female TTS was positively associated with Sexual Dimorphism Index and was negatively associated with Sexual Freedom Index-Male and Sexual Freedom Index-Female. These relationships are partially as predicted by the Social Hypothesis. While Sexual Dimorphism Index was predicted to be positively associated with Male and Female TTS (and Male TTS to a stronger degree), both Sexual Freedom Indices did not conform to the prediction that sexually freer societies would employ fewer technounits.

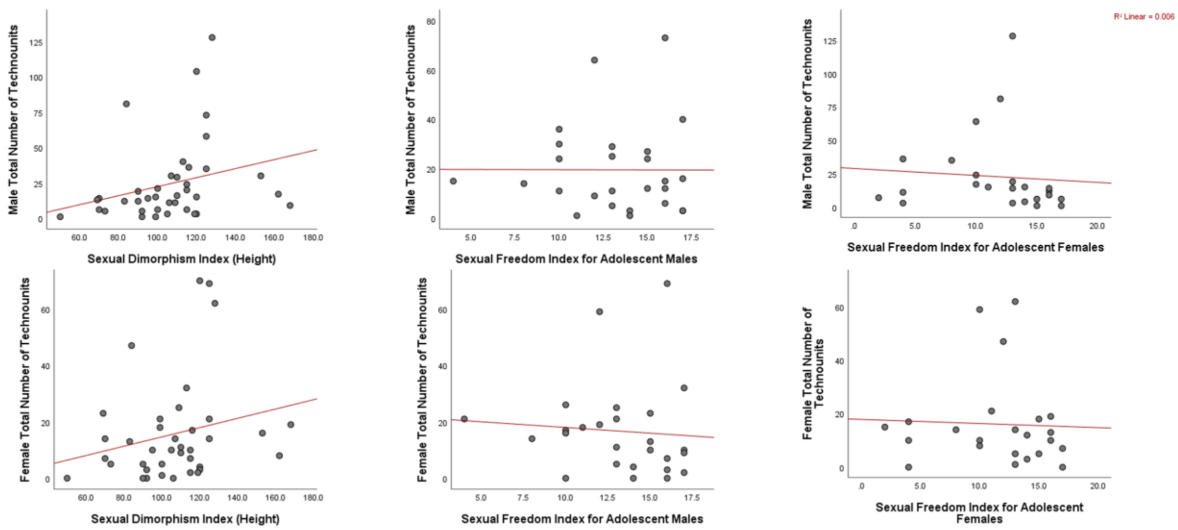

Figure 39: Top row: Scatter-plots showing the relationships between Male Total Number of Technounits and the social variables. Bottom row: Scatter-plots showing the relationships between Female Total Number of Technounits and the same three variables.

The results of the analyses in which both Male TTS and Female TTS were regressed on the social variables are summarised in Table 30. While some of the predicted directions of association were present, the lack of statistical significance means that the relationships are of little value.

*Table 30: Simple linear regression results for Male Total Number of Technounits (Male TTS), Female Total Number of Technounits (Female TTS), and the social variables. *Relationship is significant (2-tailed).*

	Sexual Dimorphism Index	**Sexual Freedom Index-Male**	**Sexual Freedom Index-Female**
Male TTS	r^2=0.048 p=.098	r^2=-0.042 p=.998	r^2=-0.041 p=.726
Female TTS	r^2=0.023 p=.178	r^2=-0.035 p=.702	r^2=-0.046 p=.855

4.2.4.3. Average Number of Technounits per Garment

Figure 40 depicts the relationships between both Male AVE, Female AVE, and the social variables Sexual Dimorphism Index, Sexual Freedom Index-Male, and Sexual Freedom Index-Female. Male AVE was positively associated with Sexual Dimorphism Index and was negatively associated with Sexual Freedom Index-Female, and had its association with Sexual Freedom Index-Male returned as an error. Female AVE had a positive relationship with Sexual Dimorphism Index and showed a negative relationship with the remaining two independent variables. These relationships are partially as predicted by the Social Hypothesis. While Sexual Dimorphism Index was predicted to be positively associated with Male and Female AVE (and Male AVE to a stronger degree), both Sexual Freedom Indices did not conform to the prediction that sexually freer societies would employ fewer garments.

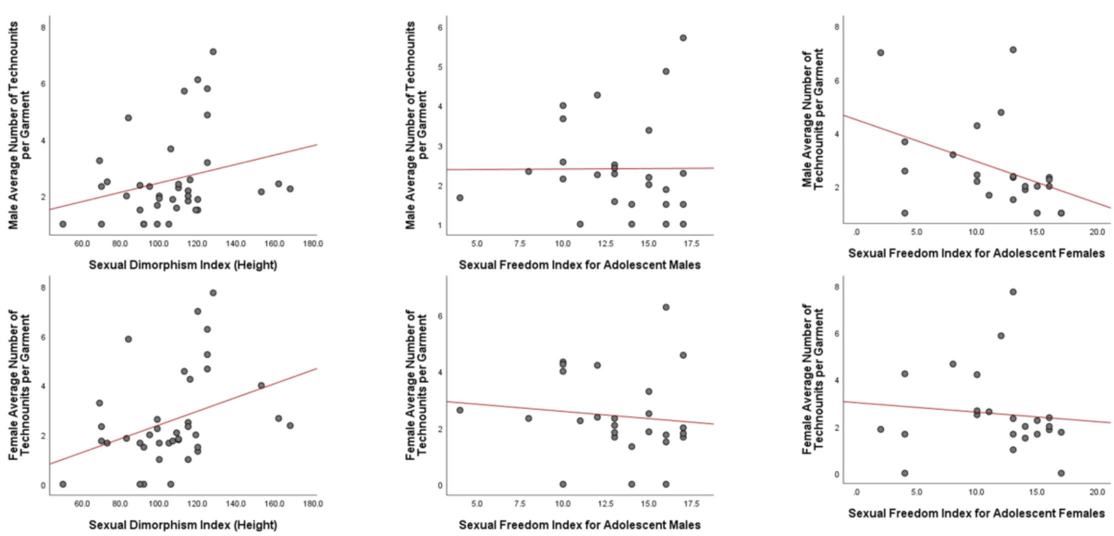

Figure 40: Top row: Scatter-plots showing the relationships between Male Average Number of Technounits per Garment and the social variables. Bottom row: Scatter-plots showing the relationships between Female Average Number of Technounits per Garment and the same three variables.

The results of the analyses in which both versions of Average Technounits per Garment were regressed on the social variables are summarised in Table 31. The association of Male AVE and the social variables reached statistical significance in one case: Sexual Freedom Index-Female (adjusted-r^2 -0.133, p=.049). For Female AVE, only its association with Sexual Dimorphism Index reached statistical significance (adjusted-r^2 0.105, p=.027). While the former result was surprising, neither supported specific hypotheses.

*Table 31: Simple linear regression results for Male Average Number of Technounits per Garment (Male AVE), Female Average Number of Technounits per Garment (Female AVE), and the social variables. *Relationship is significant (2-tailed).*

	Sexual Dimorphism Index	Sexual Freedom Index-Male	Sexual Freedom Index-Female
Male AVE	r^2=0.042 p=.113	r^2=-0.042 p=.977	r^2=0.133 p=.049*
Female AVE	r^2=0.105 p=.027	r^2=-0.029 p=.591	r^2=-0.037 p=.641

4.2.4.4. Summary of tests of the Social Hypothesis using sex differences in clothing use

The Social Hypothesis's predictions generally went unsupported, with very few statistically significant results. In some limited cases, there was some support for men's and women's garment complexity being predicted by Sexual Dimorphism Index, but the associations were very weak and were hampered by the lack of stepwise multiple regression analysis (due to the tests not reaching the threshold for statistical significance). One particularly surprising result was the negative association between Male AVE and Sexual Freedom Index-Female. That relationship suggests that as women's sexual freedom decreases, men tend to employ more complex garments.

4.3. DECORATIVE VS NON-DECORATIVE ELEMENTS OF THE WARDROBE

In analysing clothing data categorised by their decorative purpose, I aimed to show differences between clothing worn for protective and clothing worn for decorative purposes. This section does not feature the clothing variable MNL because layers are unlikely ever to be decorative.

4.3.1. Descriptive statistics for, and relationships among, the clothing variables

The descriptive statistics for the clothing data categorised by garment purpose are presented below (Table 32). Decorative TNG ranged between zero and 24, with a mean of 11.56. Non-Decorative TNG ranged between one and 35 with a mean of 9.6. Decorative TTS ranged between zero and 39, with a mean of 16.26. Non-Decorative TTS ranged between one and 219, with a mean of 46.88. Decorative AVE ranged between zero and 1.23 with a mean of 0.73. Non-Decorative AVE ranged between 0.33 and 5.7 with a mean of 1.8. All standard deviations are relatively small except for that of Non-Decorative TTS. Its standard deviation of 52.7 exceeds its mean of 46.88, suggesting a great range in cross-cultural variation of Non-Decorative garment complexity.

Table 32: Descriptive statistics of the six clothing variables when the wardrobe is divided by garment function.

	Minimum	Maximum	Mean	Std. Deviation
Decorative TNG	0	24	11.56	5.63
Non-Decorative TNG	1	35	9.60	7.36
Decorative TTS	0	39	16.26	9.25
Non-Decorative TTS	1	219	46.88	52.74
Decorative AVE	0.00	1.23	0.73	0.254
Non-Decorative AVE	0.33	5.7	1.8	1.25

The majority of the clothing variables were positively and significantly correlated with each other (Table 33). However, the Decorative and Non-Decorative variables tended to correlate more strongly with one another than they did to any in the opposite category. For example, while Decorative TNG correlated very strongly with Decorative TTS and Decorative AVE, its correlation was far weaker with Non-Decorative TNG. All of the associations within the Decorative group reached statistical significance, and the same was true of the Non-Decorative group. Except for the relationships between Non-Decorative TNG and Decorative TTS and Decorative TTS and Non-Decorative TTS, none of the relationships between the two categories reached statistical significance.

*Table 33: Relationships between the six clothing variables for the wardrobe divided by garment function (Decorative or Non-Decorative). ** Correlation is significant at the 0.05 level (2-tailed).*

	Non-Decorative TNG	Decorative TTS	Non-Decorative TTS	Decorative AVE	Non-Decorative AVE
Decorative TNG	r^2=0.170 p=.239	r^2=0.898** p=.000	r^2=0.344* p=0.14	r^2=0.714** p=.000	r^2=0.208 p=.147
Non-Decorative TNG	-	r^2=0.411** p=.000	r^2=0.846** p= .000	r^2=0.162 p=.262	r^2=0.759** p= .000
Decorative TTS		-	r^2=0.548** p= .000	r^2=0.677** p=.000	r^2=0.428** p=.002
Non-Decorative TTS			-	r^2=0.004 p=.977	r^2=0.947** p= .000
Decorative AVE				-	r^2=0.062 p=.671

4.3.2. Tests of the Environmental Hypothesis

4.3.2.1. Total Number of Garments

Figures 41 and 42 depict the relationships between the clothing variables Decorative TNG and Non-Decorative TNG and each of the environmental variables. Decorative TNG was negatively associated with Average Annual Temperature, Average Wind Chill, and Peak Wind Chill. These associations are in the direction predicted by the Environmental Hypothesis, which suggests hunter-gatherers living in warmer environments would have relatively more Decorative TNG, but not more TNG in absolute numbers. Non-Decorative TNG was negatively associated with the three environmental variables as well, but the relationships between each pairing were stronger than the ones between the environmental variables and the Decorative TNG. That result was as predicted by the Environmental Hypothesis, which suggests hunter-gatherers living in warmer climates would have fewer TNG. Decorative TNG was positively associated with Average Relative Humidity, Average Yearly Precipitation, and Average Yearly Snowfall. These results are as predicted by the Environmental Hypothesis, which suggests hunter-gatherers living in warmer environments would have more Decorative TNG. Non-Decorative TNG was positively associated with Average Relative Humidity, but was negatively associated with Average Yearly Precipitation and Average Yearly Snowfall. These results are not as predicted by the Environmental Hypothesis. Average Yearly

Precipitation was predicted to have a positive association with Non-Decorative TNG. Figure 41 also depicts the relationships between Percentage of Decorative Garments and the environmental variables Average Annual Temperature, Average Wind Chill, and Peak Wind Chill. All three relationships are positive. Those associations are as predicted by the Environmental Hypothesis, which suggests more investment in decorations by hunter-gatherers living in warmer areas.

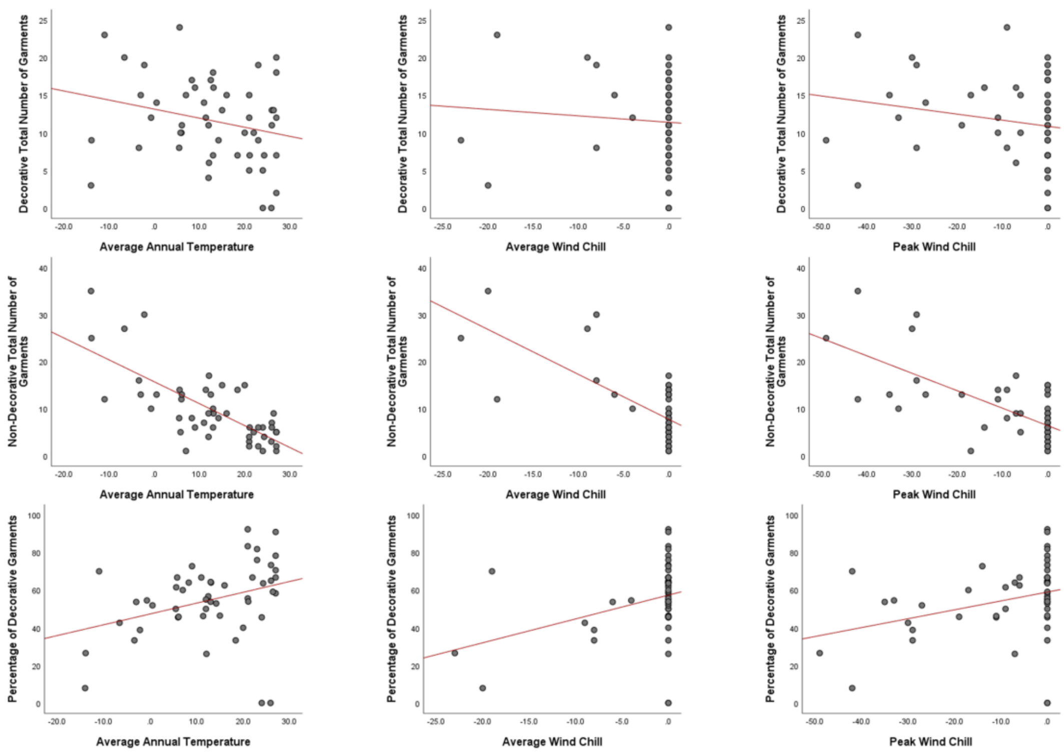

Figure 41: Top row: Scatter-plots showing the relationships between the clothing variable Decorative Total Number of Garments and the temperature-related variables.
Middle row: Scatter-plots showing the relationships between the clothing variable Non-Decorative Total Number of Garments and the temperature-related variables.
Bottom row: Scatter-plots showing the relationships between the clothing variable Percentage of Decorative Garments and the temperature-related variables.

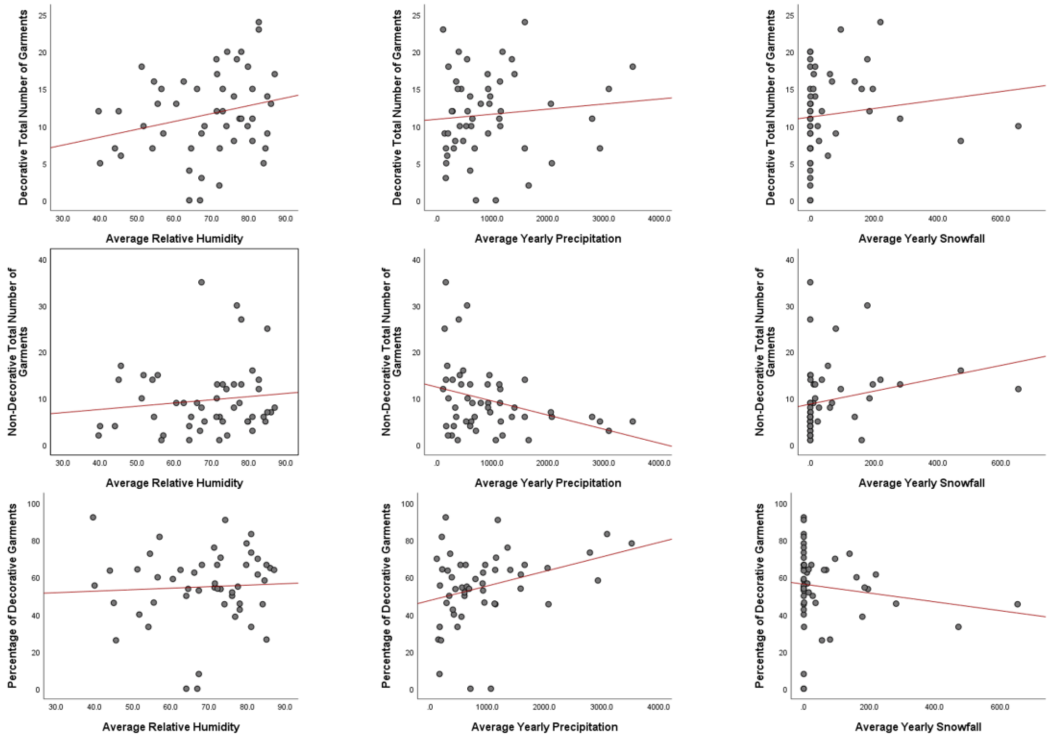

Figure 42: Top row: Scatter-plots showing the relationships between the clothing variable Decorative Total Number of Garments and the precipitation-related variables.
Middle row: Scatter-plots showing the relationships between the clothing variable Non-Decorative Total Number of Garments and the precipitation-related variables.
Bottom row: Scatter-plots showing the relationships between the clothing variable Percentage of Decorative Garments and the precipitation-related variables.

The results of the analyses in which both versions of TNG were regressed on the environmental variables are summarised in Table 34. For Decorative TNG, none of the relationships were statistically significant. For Non-Decorative TNG, four of the six relationships were statistically significant. These are the ones involving Average Annual Temperature, Average Wind Chill, Peak Wind Chill, and Average Yearly Precipitation. Three of these four statistically significant (Average Annual Temperature, Average Wind Chill, Peak Wind Chill, and Average Yearly Precipitation). For Percentage of Decorative Garments, four of the six relationships were statistically significant. These were the ones involving Average Annual Temperature, Average Wind Chill, Peak Wind Chill, and Average Yearly Precipitation.

*Table 34: Simple linear regression results for Decorative Total Number of Garments (Decorative TNG), Non-Decorative Total Number of Garments (Non-Decorative TNG), and Percentage of Decorative Garments, along with the environmental variables. *Relationship is significant (2-tailed).*

	Average Annual Temperature	**Average Wind Chill**	**Peak Wind Chill**	**Average Relative Humidity**	**Average Yearly Precipitation**	**Average Yearly Snowfall**
Decorative TNG	r^2=-.041 p=.084	r^2=-.014 p=.580	r^2=-.018 p=.172	r^2=.041 p=.085	r^2=.011 p=.498	r^2=.004 p=.373
Non-Decorative TNG	r^2=-.524 p=.000*	r^2=-.457 p=.000*	r^2=-.469 p=.000*	r^2=.006 p=.398	r^2=-.093 p=.018*	r^2=-.037 p=.095
Percentage of Decorative Garments	r^2=.092 p=.018*	r^2=.094 p=.017*	r^2=.088 p=.021*	r^2=.018 p=.715	r^2=.083 p=.024*	r^2=.002 p=.296

The stepwise multiple regression analysis focused on the Non-Decorative TNG indicates that Average Annual Temperature was the only significant correlating variable in a one-model result, with an adjusted-r2 of -0.524 (p=.000), thus explaining 52% of Non-Decorative TNG's variation. A second model also retained Average Wind Chill, boosting the predictive power, with an adjusted-r2 of -0.561 (p=.000). This result is as predicted by the Environmental Hypothesis. Non-Decorative TNG should be more strongly predicted by environmental variables than Decorative TNG.

The stepwise multiple regression analysis focused on Percentage of Decorative Garments indicated a moderate, statistically significant predictive value for Average Wind Chill on Percentage of Decorative Garments, with an adjusted-r2 of 0.094 (p=.000). This multiple regression analysis suggested that Average Wind Chill predicts 9% of the variation in Percentage of Decorative Garments. This result is as predicted by the Environmental Hypothesis. Hunter-gatherers living in warmer environments would invest relatively more in decorative clothing.

4.3.2.2. Total Number of Technounits

Figures 43 and 44 depict the relationships between both (Decorative and Non-Decorative) versions of the clothing variable TTS and the environmental variables Average Annual Temperature, Average Wind Chill, and Peak Wind Chill. Decorative TTS was negatively associated with Average Annual Temperature, Average Wind Chill, and Peak Wind Chill. This result was as predicted by the Environmental Hypothesis, which suggests relatively more investment in decorations by hunter-gatherers in warmer climates, but not more raw Decorative TTS totals. Non-Decorative TTS was negatively associated with the three environmental variables as well, and that result was in line with the predictions made by the Environmental Hypothesis, which suggests that hunter-gatherers living in colder climates would need more complex non-decorative garments. Figure 43 also depicts the relationships between Percentage of Decorative Technounits and the environmental variables Average Annual Temperature, Average Wind Chill, and Peak Wind Chill. All three relationships of those relationships were positive and were as predicted by the Environmental Hypothesis, which suggests relatively more investment in decorative clothing by hunter-gatherers in warmer climates. Figure 44 depicts both versions of the clothing variable TTS and their relationships with the environmental variables Average Relative Humidity, Average Yearly Precipitation, and Average Yearly Snowfall. Decorative TTS was positively associated with Average Relative Humidity and Average Yearly Snowfall, and was negatively associated with Average Yearly Precipitation. These results were mostly as predicted by the Environmental Hypothesis, with the exception of Average Yearly Precipitation, which was supposed to be positively associated with Non-Decorative TTS due to hunter-gatherers in wetter areas needing specialised raingear. The results suggested showed a positive relationship between Percentage of Decorative Technounits and each of the three temperature-related variables. That result suggested support for the Environmental Hypothesis, which predicts relatively high investment in decorations by hunter-gatherers living in warmer environments.

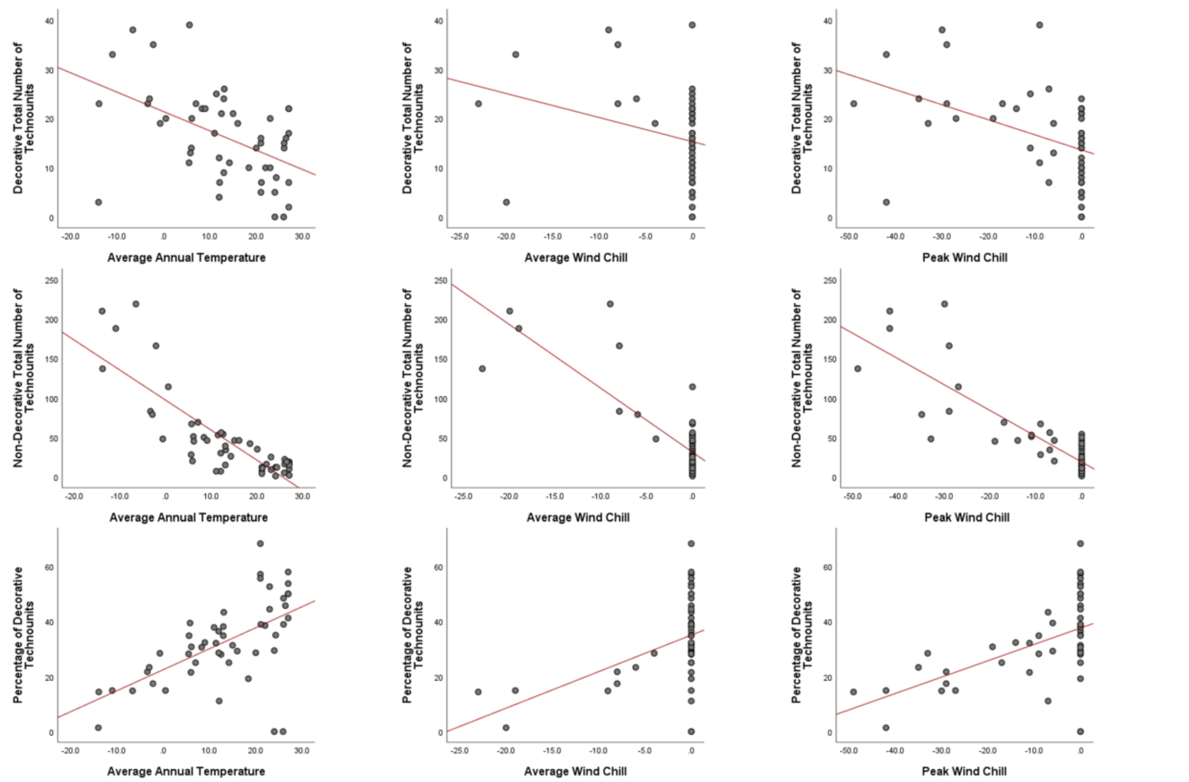

Figure 43: Top row: Scatter-plots showing the relationships between the clothing variable Decorative Total Number of Technounits and the temperature-related variables.
Middle row: Scatter-plots showing the relationships between the clothing variable Non-Decorative Total Number of Technounits and the temperature-related variables.
Bottom row: Scatter-plots showing the relationships between the clothing variable Percentage of Decorative Technounits and the temperature-related variables.

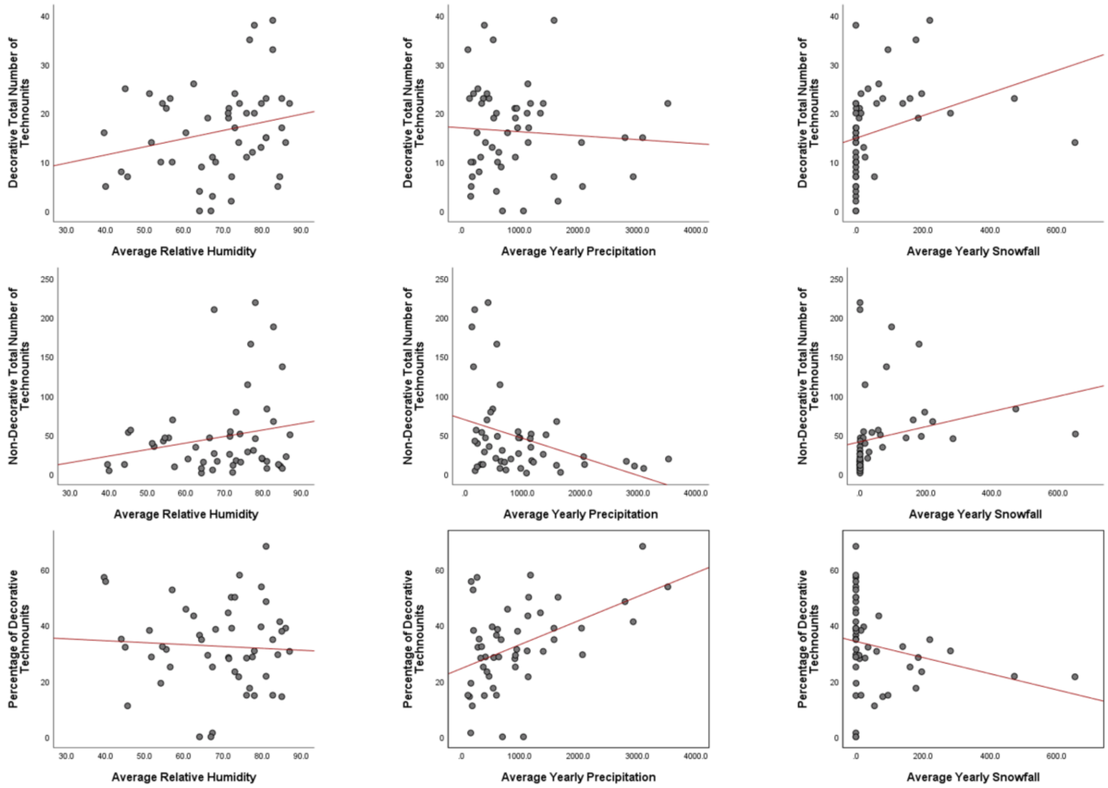

Figure 44: Top row: Scatter-plots showing the relationships between the clothing variable Decorative Total Number of Technounits and the precipitation-related variables.
Middle row: Scatter-plots showing the relationships between the clothing variable Non-Decorative Total Number of Technounits and the precipitation-related variables.
Bottom row: Scatter-plots showing the relationships between the clothing variable Percentage of Decorative Technounits and the precipitation-related variables.

The results of the analyses in which both versions of TTS were regressed on the environmental variables are summarised in Table 35. For Decorative TTS, none of the relationships were statistically significant. For Non-Decorative TTS, three of the six relationships were statistically significant. These are the ones involving Peak Wind Chill, Average Yearly Precipitation, and Average Yearly Snowfall. These statistically significant relationships were in the predicted direction except for Average Yearly Precipitation. For Percentage of Decorative Technounits, four of the six relationships were statistically significant. These relationships were the ones involving Average Annual Temperature, Average Wind Chill, Peak Wind Chill, and Average Yearly Precipitation.

Table 35: Simple linear regression results for Decorative Total Number of Technounits (Decorative TTS), Non-Decorative Total Number of Technounits (Non-Decorative TTS), and Percentage of Decorative Technounits, along with the environmental variables.

	Average Annual Temperature	Average Wind Chill	Peak Wind Chill	Average Relative Humidity	Average Yearly Precipitation	Average Yearly Snowfall
Decorative TTS	r^2=-.041 p=.084	r^2=-.058 p=.051	r^2=-.189 p=.001*	r^2=.035 p=.101	r^2=-.016 p=.026*	r^2=.081 p=.026*
Non-Decorative TTS	r^2=-.616 p=.000*	r^2=-.806 p=.000*	r^2=-.714 p=.000*	r^2=.029 p=.124	r^2=-.109 p=.011*	r^2=.008 p=.245
Percentage of Decorative Technounits	r^2=.322 p=.000*	r^2=.094 p=.017*	r^2=.274 p=.000*	r^2=.017 p=.687	r^2=.194 p=.001*	r^2=.038 p=.092

The stepwise multiple regression analysis focused on Decorative TTS indicates that Average Annual Temperature was the only significant correlating variable in a one-model result, with an adjusted-r2 of -0.224 (p=.000), thus explaining 22.4% of the variation in Decorative TTS. This result is as predicted by the Environmental Hypothesis that suggests relatively high decorative investment by hunter-gatherers living in warm environments, but that investment should not necessarily lead to absolutely high TTS. The multiple regression analysis focused on Non-Decorative TTS yielded four models. The first retained only Peak Wind Chill (adjusted-r2 -0.713, p=0.000). The second added Average Wind Chill (adjusted-r2 -0.737, p=.000), the third added Average Wind Chill and Average Annual Temperature (adjusted-r2 -0.764, p=.000), and the fourth has Average Wind Chill and Average Annual Temperature without Peak Wind Chill (adjusted-r2 -0.763, p=.000). All of these models suggested support for the Environmental Hypothesis, which predicted that hunter-gatherers living in colder areas would have their wardrobes be more strongly influenced by temperature-related variables than hunter-gatherers living in warmer areas would be.

The stepwise multiple regression analysis focused on Percentage of Decorative Technounits returned a similar result to that of Percentage of Decorative Garments, with an adjusted-r2 of 0.322 (p=.000). This multiple regression analysis suggests that Average Annual Temperature predicts 32% of the variation in Percentage of Decorative Technounits. This result is as predicted by the Environmental Hypothesis, which suggests relatively high investment in decorative aspects of clothing by hunter-gatherers in warmer environments.

4.3.2.3. Average Number of Technounits per Garment

Figure 45 depicts the relationships between both (Decorative and Non-Decorative) versions of the clothing variable AVE and the environmental variables Average Annual Temperature, Average Wind Chill, and Peak Wind Chill. Decorative AVE was negatively associated with Average Annual Temperature and Peak Wind Chill, and was positively associated with Average Wind Chill. The direction of these results is not in line with those of Decorative TNG and TTS, but are not necessarily unsupportive of the Environmental Hypothesis. The Environmental Hypothesis does not predict a specific direction for Decorative TNG, TTS, and AVE so much as it predicts a specific one for relative investment variables such as Percentage of Decorative Garments and Percentage of Decorative Technounits. Non-Decorative AVE was negatively associated with all three environmental variables, but the relationships between each pairing of Non-Decorative AVE and environmental variables are stronger than the ones between the environmental variables and Decorative AVE. This result is as predicted by the Environmental Hypothesis, which predicts that Non-Decorative AVE would be strongly associated with temperature-related variables. Figure 46 depicts both versions of the clothing variable AVE and their relationships to the environmental variables Average Relative Humidity, Average Yearly Precipitation, and Average Yearly Snowfall. Decorative AVE is positively associated with Average Relative Humidity, Average Yearly Precipitation, and Average Yearly Snowfall. Non-Decorative AVE displays the same pattern of associations, except that Average Yearly Precipitation has a negative association. The directions are as predicted with exception of the relationship between Non-Decorative AVE and Average Yearly Precipitation, which is not in line with the Environmental Hypothesis. That hypothesis suggests that specialised raingear would be needed by hunter-gatherers living in wetter areas.

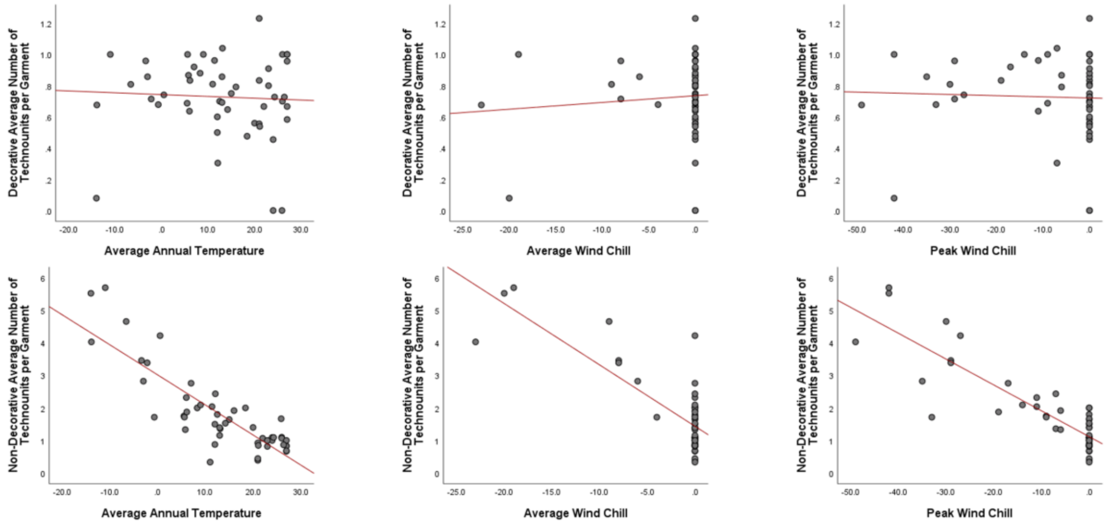

Figure 45: Scatter-plots showing the relationships between Decorative Average Number of Technounits and the temperature-related variables. Bottom row: Scatter-plots showing the relationships between the clothing variable Non-Decorative Average Number of Technounits and the temperature-related variables.

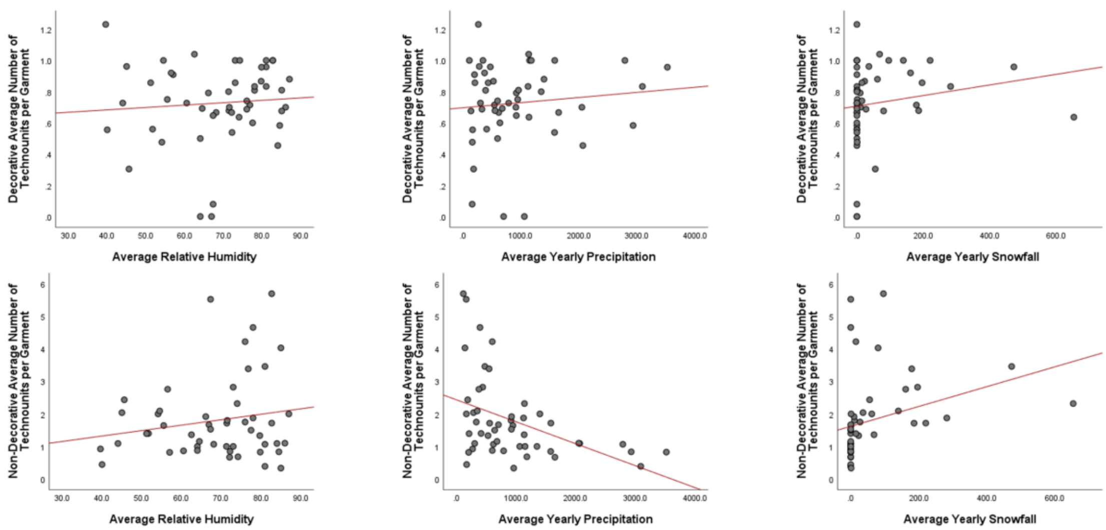

Figure 46: Top row: Scatter-plots showing the relationships between Decorative Average Number of Technounits and the precipitation-related variables. Bottom row: Scatter-plots showing the relationships between the clothing variable Non-Decorative Average Number of Technounits and the precipitation-related variables.

The results of the analyses in which both versions of Average Technounits per Garment were regressed on the environmental variables are summarised in Table 36. For Decorative AVE, none of the relationships were statistically significant. For Non-Decorative AVE, four of the six relationships were statistically significant. These were the ones involving Average Annual Temperature, Average Wind Chill, Peak Wind Chill, and Average Relative Humidity.

*Table 36: Simple linear regression results for Decorative Average Number of Technounits per Garment (Decorative AVE) and Non-Decorative Average Technounits per Garment (Non-Decorative AVE), along with the environmental variables. *Relationship is significant (2-tailed).*

	Average Annual Temperature	Average Wind Chill	Peak Wind Chill	Average Relative Humidity	Average Yearly Precipitation	Average Yearly Snowfall
Decorative AVE	r^2=-.018 p=.715	r^2=.013 p=.533	r^2=-.019 p=.780	r^2=.015 p=.587	r^2=.010 p=.468	r^2=.008 p=.242
Non-Decorative AVE	r^2=-.616 p=.000*	r^2=-.806 p=.000*	r^2=-.714 p=.000*	r^2=.029 p=.124	r^2=-.109 p=.011*	r^2=.008 p=.025*

4.3.2.4. Summary of test of the Environmental Hypothesis using data for decorative and non-decorative elements of the wardrobe

The results indicated further support for the hypothesis that hunter-gatherers living in colder environments require richer wardrobes and more complex clothing. Furthermore, the results offered support for the hypothesis that Non-Decorative clothing would be far more closely associated with environmental variables than Decorative clothing would be. The results also suggested support for the hypothesis that Peak Wind Chill was a factor specifically constraining certain garment designs in particularly cold areas. The results pertaining to Percentage of Decorative Garments and Percentage of Decorative Technounits offered support for the hypotheses that cultures living in warmer climates will invest relatively more into decorative garments and components, since they can invest less in clothing related to survival.

4.3.3. Tests of the Economic Hypothesis

4.3.3.1. Total Number of Garments

Figure 47 depicts the relationships between the clothing variables Decorative TNG and Non-Decorative TNG and the economic variables Percentage of Subsistence from Fishing, Percentage of Subsistence from Hunting, and Percentage of Subsistence from Gathering. Decorative TNG was negatively associated with Percentage of Subsistence from Hunting and Percentage of Subsistence from Gathering, but is positively associated with Percentage of Subsistence from Fishing. Non-Decorative TNG had the same directions in its associations. These directions are as predicted by the Economic

Hypothesis, which predicts more wardrobe richness for cultures relying more heavily on fishing and less richness for groups relying more heavily on gathering.

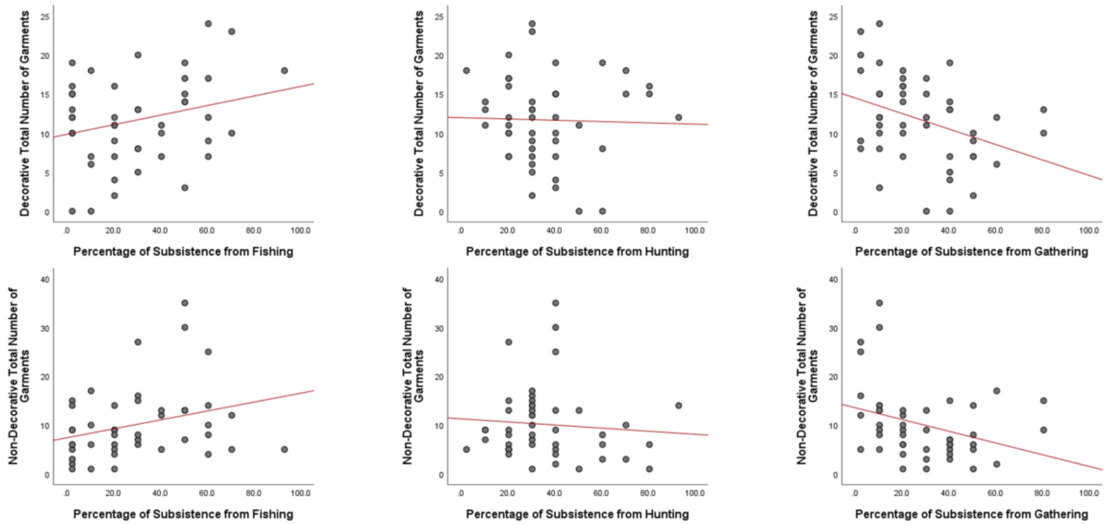

Figure 47: Top row: Scatter-plots showing the relationships between Decorative Total Number of Technounits and the subsistence variables. Bottom row: Scatter-plots showing the relationships between Non-Decorative Total Number of Technounits and the subsistence variables.

The results of the analyses in which both versions of Total Number of Garments were regressed on the economic variables, and are summarised in Table 37. For Decorative TNG, only the association with Percentage of Subsistence from Gathering was statistically significant. For Non-Decorative TNG, two of the three relationships were statistically significant (Percentage of Subsistence from Fishing and Percentage of Subsistence from Gathering). The relationships between Decorative TNG and the economic variables were in the predicted directions. The relationships between Non-Decorative TNG and the economic variables were mixed in terms of their closeness with predictions. Percentage of Subsistence from Fishing and Percentage of Subsistence from Gathering were in the predicted direction, but Percentage of Subsistence from Hunting was not. Percentage of Subsistence from Hunting’s relationship with Non-Decorative TNG was also not statistically significant, so its relationship is of little consequence, but the remaining two economic variables had statistically significant relationships with Non-Decorative TNG.

*Table 37: Simple linear regression results for Decorative Total Number of Garments (TNG) and Non-Decorative Total Number of Garments (TNG), along with the environmental variables. *Relationship is significant (2-tailed).*

	Percentage of Subsistence from Fishing	Percentage of Subsistence from Hunting	Percentage of Subsistence from Gathering
Decorative TNG	r^2=.047 p=.080	r^2=-.022 p=.845	r^2=-.108 p=.015*
Non-Decorative TNG	r^2=.065 p=.049*	r^2=-.015 p=.574	r^2=-.086 p=.027

The stepwise multiple regression analysis performed for Decorative TNG suggested that only Percentage of Subsistence from Gathering explained more than a tiny amount of the variation in the variation of the clothing variable. Percentage of Subsistence from Gathering yielded an adjusted-r2 of -0.108 (p=.015), suggesting it explains 11% of the variation in Decorative TNG. For Non-Decorative TNG, Percentage of Subsistence from Gathering was the only significant predictor with an adjusted-r2 of -0.086 (p=.027). These results were as predicted by the Economic Hypothesis, which predicted that hunter-gatherers relying more heavily on gathering would have less rich wardrobes.

Figures 48 and 49 compare both Decorative and Non-Decorative versions of the clothing variable TNG against Food Storage Complexity and Mobility. The results indicated that more complex food storage strategies were associated with richer wardrobes. The effect seems to be stronger with regard to Non-Decorative TNG. These results are as predicted by the Economic Hypothesis, which predicts a positive association between complexity of Food Storage strategies and TNG. In addition, the results suggested a positive association between sedentism and Decorative TNG, but not one between sedentism and Non-Decorative TNG. These results are in line with the predictions made by the Economic Hypothesis. However, the relatively large difference between Decorative TNG and Non-Decorative TNG and Mobility was unexpected.

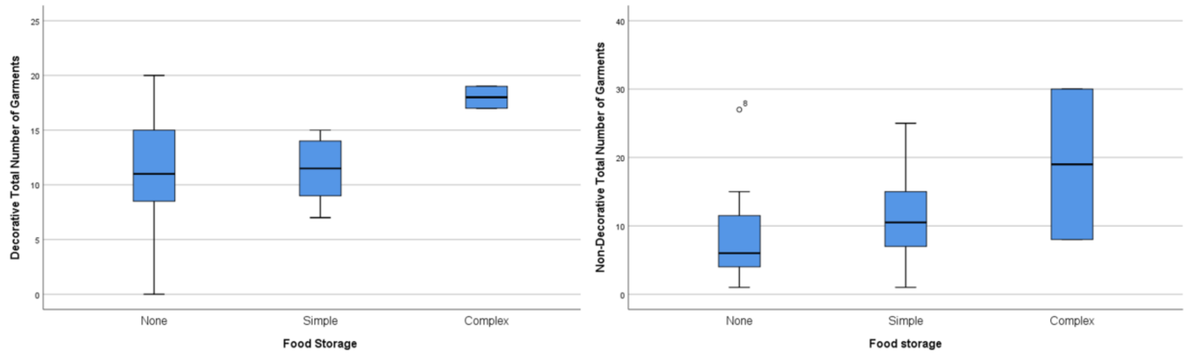

Figure 48: Box plots depicting the relationships between Decorative Total Number of Garments and Non-Decorative Total Number of Garments and the categorical variable Food Storage Complexity.

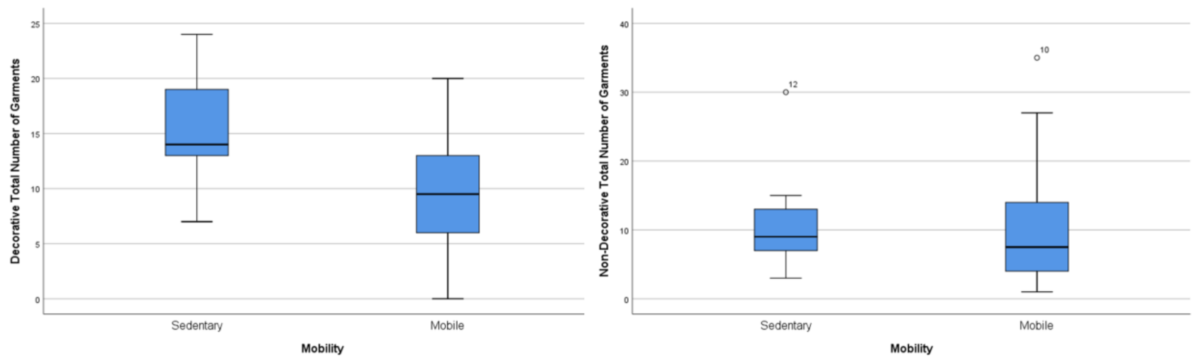

Figure 49: Box plots depicting the relationships between Decorative Total Number of Garments and Non-Decorative Total Number of Garments and the categorical variable Mobility.

4.3.3.2. Total Number of Technounits

Figure 50 depicts the relationships between Decorative TTS and Non-Decorative TTS and the economic variables Percentage of Subsistence from Fishing, Percentage of Subsistence from Hunting, and Percentage of Subsistence from Gathering. Decorative TTS was negatively associated with Percentage of Subsistence from Gathering and was positively associated with Percentage of Subsistence from Fishing. Non-Decorative TTS had the same pattern of relationships. These directions are as predicted by the Economic Hypothesis, which predicts more technounits for cultures relying more heavily on fishing and fewer for groups relying more heavily on gathering.

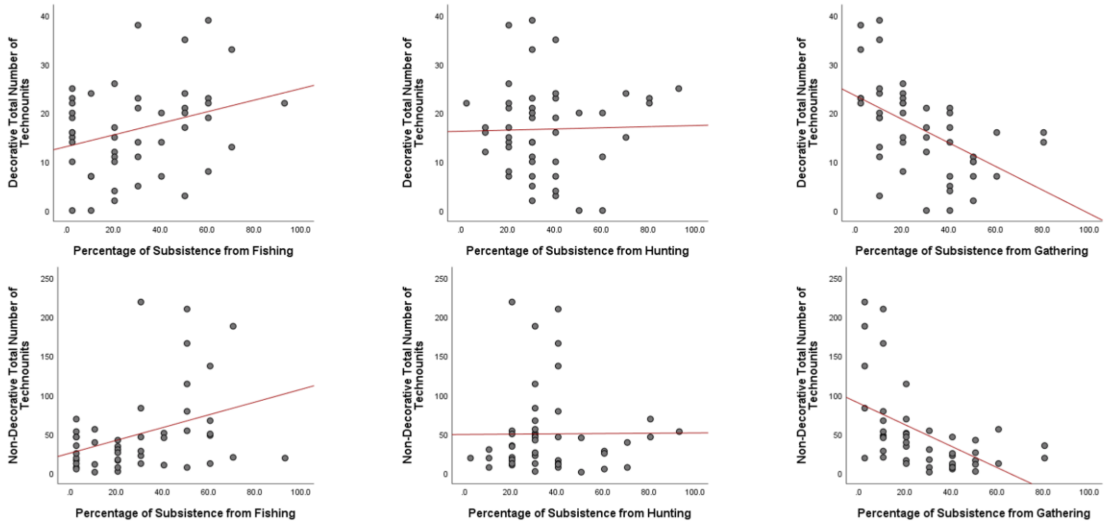

Figure 50: Top row: Scatter-plots showing the relationships between Decorative Total Number of Technounits and the subsistence variables. Bottom row: Scatter-plots showing the relationships between Non-Decorative Total Number of Technounits and its relationship with the same variables.

The results of regressing both versions of TTS on the economic variables are summarised in Table 38. For Decorative TNG, two of the three relationships were statistically significant. These relationships were with Percentage of Subsistence from Fishing and Percentage of Subsistence from Gathering. For Non-Decorative TTS, the same distribution of significant relationships was found: Percentage of Subsistence from Fishing and Percentage of Subsistence from Gathering.

*Table 38: Simple linear regression results for Decorative Total Number of Technounits (TTS) and Non-Decorative Total Number of Technounits (TTS), along with the environmental variables. *Relationship is significant (2-tailed).*

	Percentage of Subsistence from Fishing	**Percentage of Subsistence from Hunting**	**Percentage of Subsistence from Gathering**
Decorative TTS	r^2=0.070 p=.042*	r^2=0.022 p=.869	r^2=-0.256 p=.000*
Non-Decorative TTS	r^2=0.109 p=.014*	r^2=0.023 p=.962	r^2=-0.248 p=.000*

The stepwise multiple regression analysis focused on the Decorative TTS indicated that Percentage of Subsistence from Gathering was the only significant predictor of variation in Decorative TTS, with an adjusted-r2 of -0.256 (p=.000). This result indicated that Percentage of Subsistence from Gathering explains 26% of the variation in Decorative

TTS. The multiple regression analysis focused on Non-Decorative TTS indicated a similar result, with an adjusted-r2 of -0.248 (p=.000). These results were as predicted by the Economic Hypothesis, which predicted that hunter-gatherers relying more heavily on gathering would employ fewer technounits.

Figure 51 compares both Decorative TTS and Non-Decorative TTS against Food Storage Complexity. The Figure both supported the hypothesis that more complex food storage strategies are associated with more complex garments. Figure 52 compares both Decorative TTS and Non-Decorative TTS with Mobility. The results suggested that hunter-gatherers with more complex food storage strategies have more Decorative and Non-Decorative TTS. These results are as predicted by the Economic Hypothesis, which predicts a positive association between complexity of Food Storage strategies and TNG. Furthermore, the results suggest more sedentary societies have more Decorative TTS but not more Non-Decorative TTS. These results are in line with the predictions made by the Economic Hypothesis, which predicts more sedentary societies would have more TTS. However, as with the relationship between Mobility and Decorative/Non-Decorative TNG, the relatively large difference between Decorative TTS and Non-Decorative TTS and Mobility was unexpected.

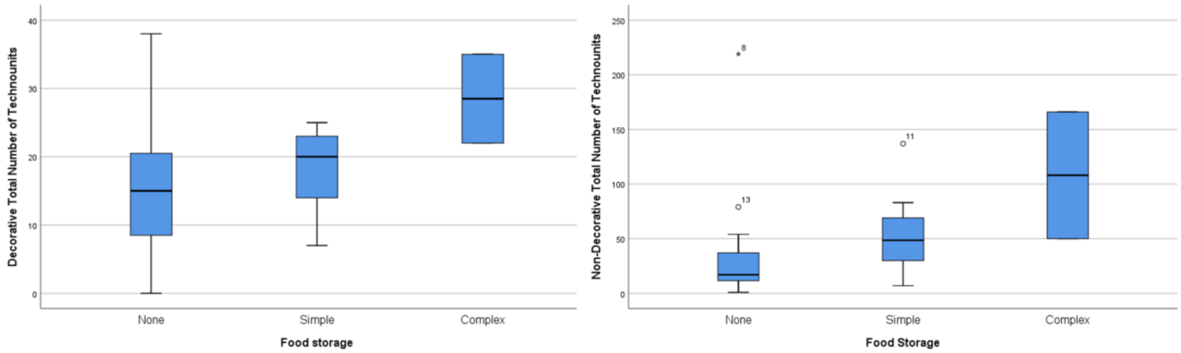

Figure 51: Box plots depicting the relationships between Decorative Total Number of Technounits and Non-Decorative Total Number of Technounits and the categorical variable Food Storage Complexity.

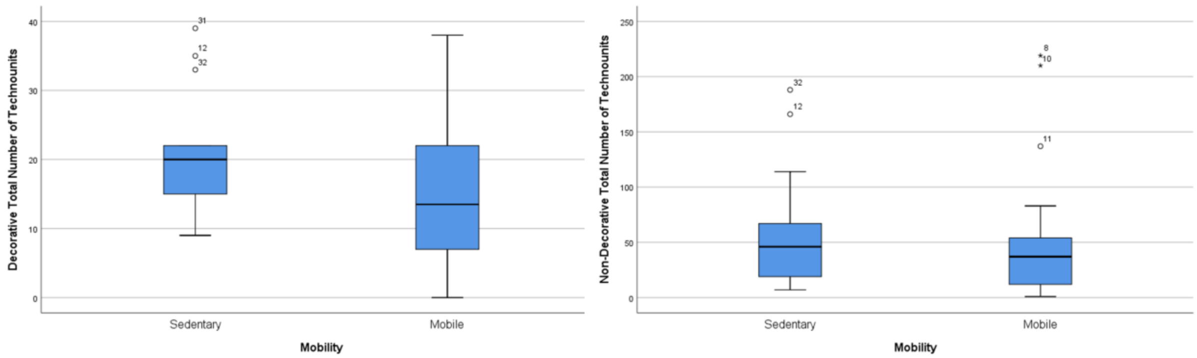

Figure 52: Box plots depicting the relationships between Decorative Total Number of Technounits and Non-Decorative Total Number of Technounits and the categorical variable Mobility.

4.3.3.3. Average Number of Technounits per Garment

Figure 53 depicts the relationships between both Decorative and Non-Decorative AVE and the environmental variables Percentage of Subsistence from Fishing, Percentage of Subsistence from Hunting, and Percentage of Subsistence from Gathering. Decorative AVE was positively associated with Percentage of Subsistence from Fishing and was negatively associated with Percentage of Subsistence from Hunting and Percentage of Subsistence from Gathering. Non-Decorative AVE was positively associated with Percentage of Subsistence from Fishing and Percentage of Subsistence from Hunting and was negatively associated with Percentage of Subsistence from Gathering. These directions are as predicted by the Economic Hypothesis, which predicts a higher average garment complexity for cultures relying more heavily on fishing and a lower one for groups relying more heavily on gathering.

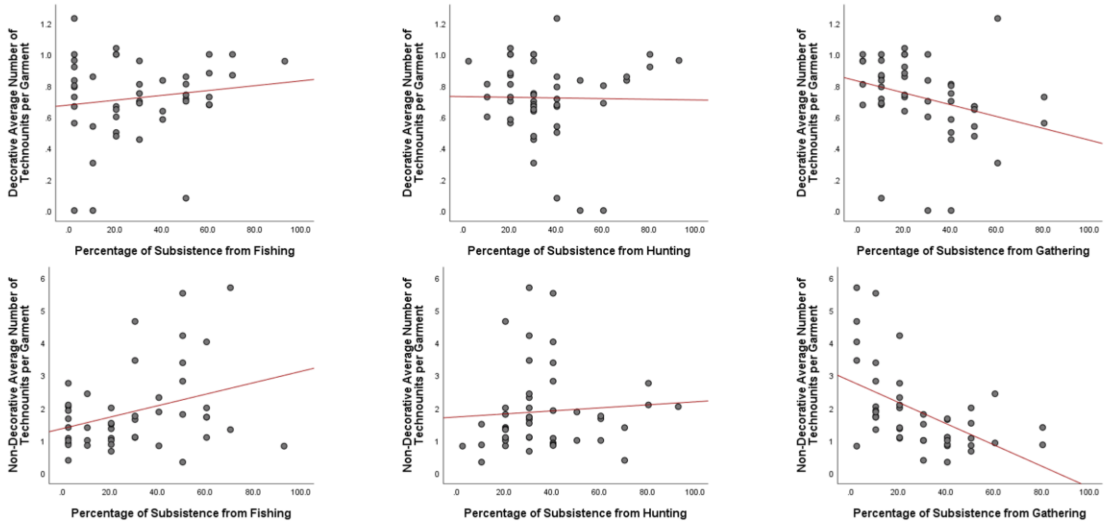

Figure 53: Top row: Decorative Average Number of Technounits and its associations with the subsistence variables. Bottom row: Non-Decorative Average Number of Technounits and its associations with the same three variables.

The results of the analyses in which Decorative and Non-Decorative AVE were regressed on the economic variables are summarised in Table 39. For Decorative AVE, only the relationship with Percentage of Subsistence from Gathering was statistically significant. Non-Decorative AVE, two of the three (Percentage of Subsistence from Fishing and Percentage of Subsistence from Gathering) were statistically significant.

*Table 39: Simple linear regression results for Decorative Average Number of Technounits per Garment (Decorative AVE) and Non-Decorative Average Number of Technounits per Garment (Non-Decorative AVE), along with the environmental variables. *Relationship is significant (2-tailed).*

	Percentage of Subsistence from Fishing	**Percentage of Subsistence from Hunting**	**Percentage of Subsistence from Gathering**
Decorative AVE	r^2=.002 p=.347	r^2=-.022 p=.913	r^2=-.066 p=.046*
Non-Decorative AVE	r^2=.088 p=.025*	r^2=.017 p=.627	r^2=-.253 p=.000*

The stepwise multiple regression analysis focused on the Decorative AVE indicates that Percentage of Subsistence from Gathering was the only significant predictor of variation in Decorative AVE (adjusted-r^2 -0.066, p=.046), with 7% variation explained. The multiple regression analysis focused on Non-Decorative AVE has a similar result, but a stronger signal (Percentage of Subsistence from Gathering had an adjusted-r^2 of -0.253, p=.000). These results were as predicted by the Economic Hypothesis, which predicted that hunter-gatherers relying more heavily on gathering would have lower average garment complexity.

Figure 54 depicts both Decorative and Non-Decorative AVE plotted against Food Storage Complexity. The results suggested a slight tendency toward hunter-gatherers with more complex food storage also having a higher Non-Decorative AVE. That pattern held for Decorative AVE, but only to a small degree. These results were as predicted by the Economic Hypothesis, which predicted a positive association between Food Storage complexity and AVE. Figure 55 depicts the relationship between Decorative and Non-Decorative AVE and Mobility. That Figure suggested more sedentary groups tended to have higher AVE. That result was as predicted by the Economic Hypothesis, which suggested a positive association between sedentism and AVE. However, the sharp difference between Decorative and Non-Decorative TNG and TTS was not seen with AVE, suggesting more sedentary hunter-gatherers employ more garments, but not necessarily more complex garments.

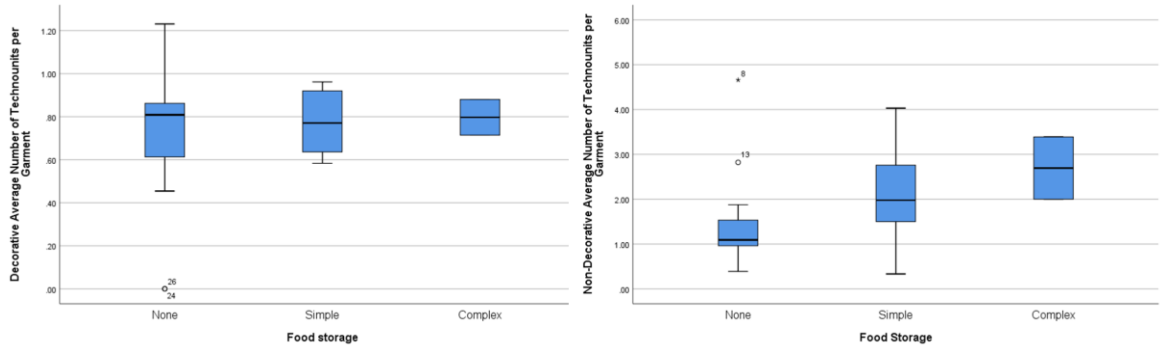

Figure 54: Box plots depicting the relationships between Decorative Average Number of Technounits and Non-Decorative Average Number of Technounits and the categorical variable Food Storage Complexity.

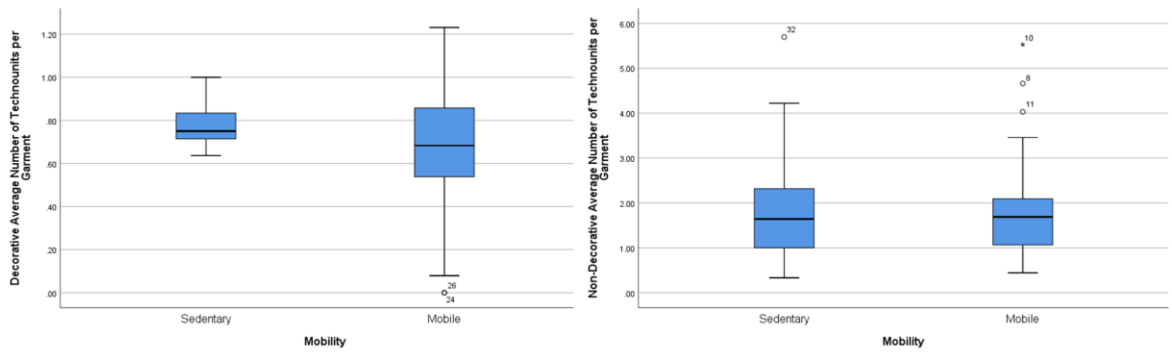

Figure 55: Box plots depicting the relationships between Decorative Average Number of Technounits and Non-Decorative Average Number of Technounits and the categorical variable Mobility.

4.3.3.4. Summary of results of tests of Economic Hypothesis

The results offered some support for the hypothesis that Non-Decorative clothing would be more strongly associated with subsistence variables; however, the overall degrees of association were low and statistical significance was not often reached across all subsistence categories. Fishing seems to be associated with Non-Decorative clothing variables, thus supporting the hypothesis that cultures relying more heavily on fishing would require more garments and somewhat more complex garments. However, the stepwise multiple regression analysis indicated that Subsistence from Gathering was a far stronger predictor of TNG, TTS, and AVE variation than Subsistence from Fishing. The results did not support the hypothesis that Decorative and Non-Decorative clothing variables would be equally associated with complexity of food storage and mobility. Sedentary societies showed a strong tendency toward having more decorative clothing while groups employing more complex food storage techniques tended to have larger Non-Decorative clothing values. In addition, the results suggested that more sedentary hunter-gatherers have more garments, but not necessarily more complex garments.

4.3.4. Tests of the Social Hypothesis

4.3.4.1. Total Number of Garments

Figure 56 depicts the relationships between the clothing variables Decorative TNG and Non-Decorative TNG and the social variables Sexual Dimorphism Index, Sexual Freedom Index-Male, and Sexual Freedom Index-Female. Decorative TNG was positively associated with Sexual Dimorphism Index, negatively associated with Sexual Freedom Index-Male, and was not associated with Sexual Freedom Index-Female. Non-Decorated TNG was positively associated with Sexual Dimorphism Index and negatively associated with Sexual Freedom Index-Male, and Sexual Freedom Index-Female. These results are partially as-predicted by the Social Hypothesis: Sexual Dimorphism was predicted to be positively associated with Decorative TNG, but the Sexual Freedom Indices were predicted to be positively associated as well.

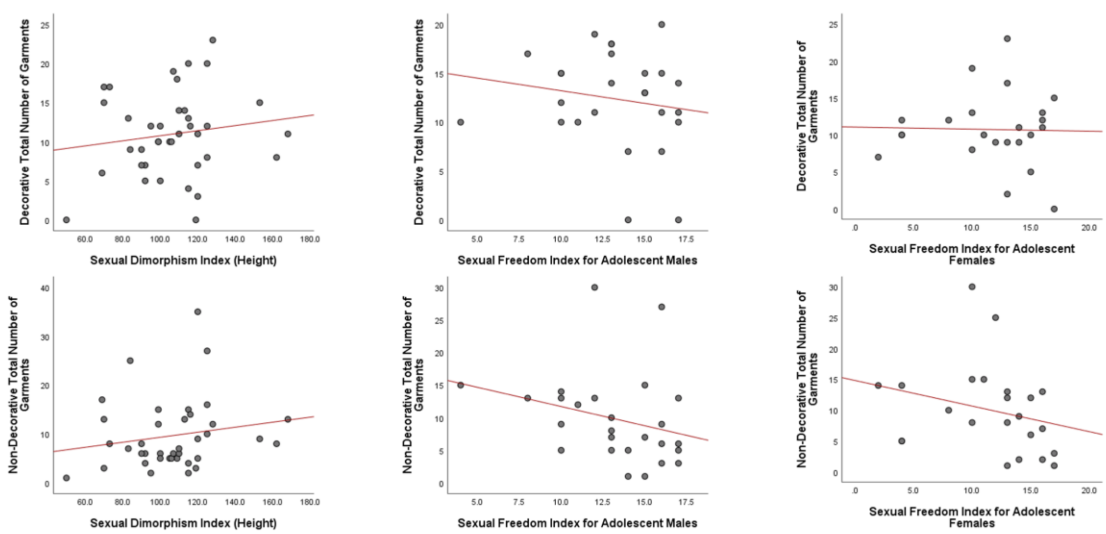

Figure 56: Top row: Scatter-plots showing the relationships between Decorative Total Number of Garments and the social variables. Bottom row: Scatter-plots showing the relationships between Non-Decorative Total Number of Garments and the same variables.

Table 40 depicts the results of regressing Decorative and Non-Decorative TNG on the social variables Sexual Freedom Index-Female. For Decorative TNG, none of the associations were strong or statistically significant. For Non-Decorative TNG, the associations were slightly stronger, but none reached statistical significance. Therefore, the associations are of little consequence.

*Table 40: Simple linear regression results for Decorative Total Number of Garments (Decorative TNG) and Non-Decorative Total Number of Garments (Non-Decorative TNG), along with the social variables. *Relationship is significant (2-tailed).*

	Sexual Dimorphism Index	Sexual Freedom Index-Male	Sexual Freedom Index-Female
Decorative TNG	r^2=0.005 p=.377	r^2=-0.013 p=.419	r^2=-0.047 p=.910
Non-Decorative TNG	r^2=0.004 p=.294	r^2=-0.037 p=.176	r^2=-0.022 p=.235

Figure 57 depicts Decorative and Non-Decorative TNG plotted against the categorical variable Martial Composition. The results indicated a clear trend toward polygynous societies having richer wardrobes than monogamous ones. This result was as predicted by the Social Hypothesis, which suggested that more polygynous societies would employ more Decorative TNG, and as a corollary, fewer Non-Decorative TNG.

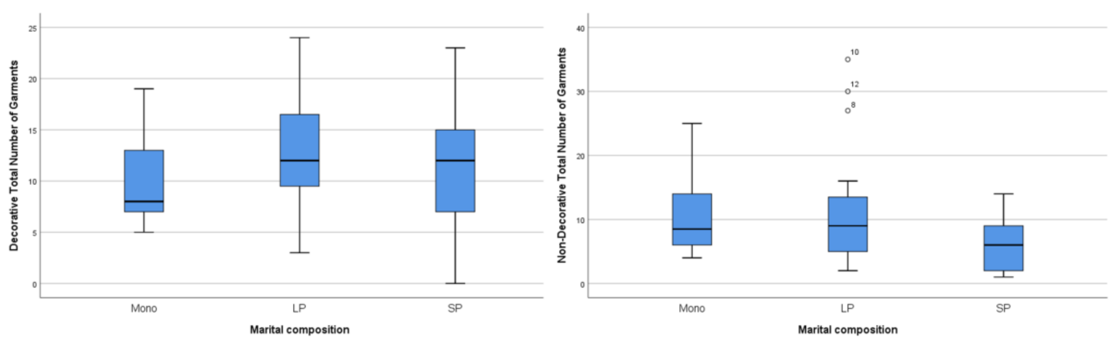

Figure 57: Box plots depicting the relationships between Decorative Total Number of Garments and Non-Decorative Total Number of Garments and the categorical variable Martial Composition: Monogamous (Mono), Limited Polygynous (LP), and Strongly Polygynous (SP).

Figures 58 and 59 are plots of Decorative and Non-Decorative TNG against Ingroup and Outgroup Violence respectively. The aspect of the Social Hypothesis, that the correlation between wardrobe richness and violence would not extend to ingroup violence was not supported. There was, however, support for the Social Hypothesis, in that more warlike societies would tend to have richer decorative wardrobes. There was a clear signal that, at least with regard to Non-Decorative TNG, societies with more ingroup violence tend to have richer wardrobes.

Figure 60 is a series of plots of Percentage of Decorative Garments showing its relationships with the categorical variables Marital Composition, Ingroup Violence, and Outgroup Violence. The results suggested support for the Social Hypothesis that more polygynous societies would invest more into decorative clothing, although that pattern was only prominent with regard to wardrobe richness rather than individual clothing components. The results also provided some support for the hypothesis that more warlike societies will invest more into more richly-decorative wardrobes. Of note is a slight signal was present that groups with ‘present’ Ingroup Violence tend to have fewer TNG, therefore going against the Social Hypothesis, which supposes such a difference should not be present.

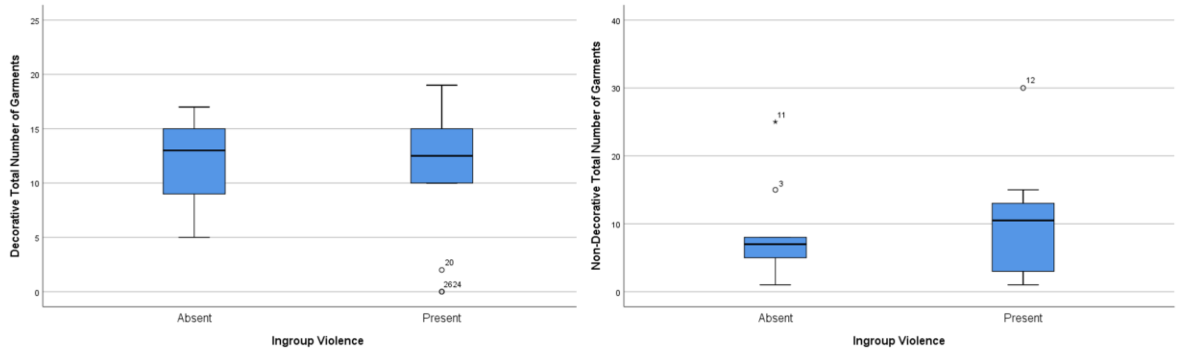

Figure 58: Box plots depicting the relationships between Decorative Total Number of Garments and Non-Decorative Total Number of Garments and the categorical variable Ingroup Violence.

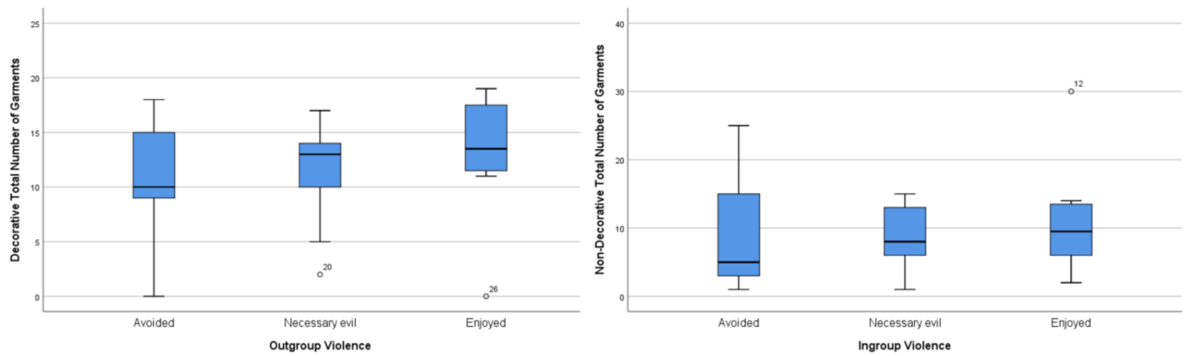

Figure 59: Box plots depicting the relationships between Decorative Total Number of Garments and Non-Decorative Total Number of Garments and the categorical variable Outgroup Violence.

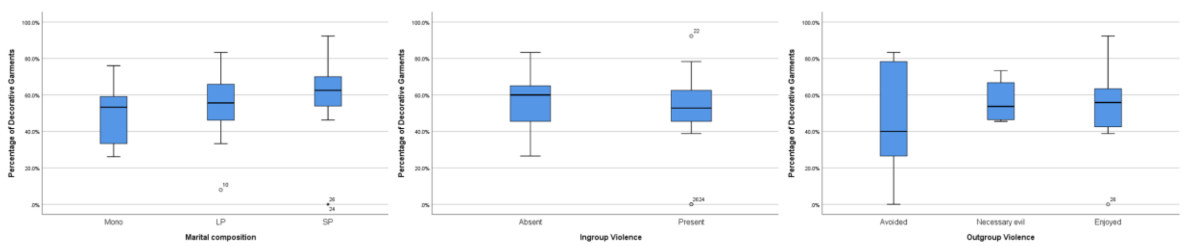

Figure 60: Percentage of Decorative Garments and Percentage of Decorative Technounits plotted against Marital Composition, Ingroup Violence, and Outgroup Violence. Top row: Percentage of Decorative Garments; left to right: Marital Composition, Ingroup Violence, Outgroup Violence.

4.3.4.2. Total Number of Technounits

Figure 61 depicts the relationships between Decorative and Non-Decorative TTS and the social variables Sexual Freedom Index-Female. Decorative TTS was positively associated with Sexual Dimorphism Index and negatively associated with Sexual Freedom Index-Male and Sexual Freedom Index-Female. Non-Decorative TTS displays the same pattern of direction of associations. These results are partially as-predicted by the Social Hypothesis: Sexual Dimorphism was predicted to be positively associated with Decorative TNG, but the Sexual Freedom Indices were predicted to be positively associated as well.

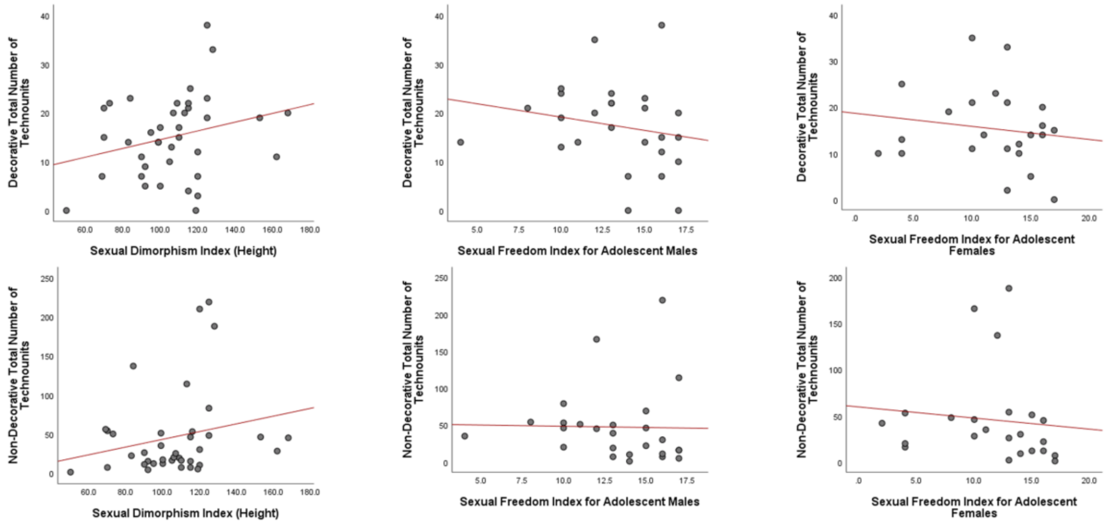

Figure 61: Top row: Scatter-plots showing the relationships between Decorative Total Number of Technounits and the social variables. Bottom row: Scatter-plots showing the relationships between Non-Decorative Total Number of Technounits and same variables.

The results of the analyses in which both Decorative and Non-Decorative TTS are summarised in Table 41. For Decorative TTS, none of the relationships were statistically significant. The same pattern was true of Non-Decorative TTS.

*Table 41: Simple linear regression results for Decorative Total Number of Technounits (Decorative TTS) and Non-Decorative Total Number of Technounits (Non-Decorative TTS), along with the social variables. *Relationship is significant (2-tailed).*

	Sexual Dimorphism Index	**Sexual Freedom Index-Male**	**Sexual Freedom Index-Female**
Decorative TTS	r^2=0.043 p=.112	r^2=0.000 p=.330	r^2=-0.024 p=.497
Non-Decorative TTS	r^2=0.021 p=.187	r^2=-0.041 p=.919	r^2=-0.035 p=.625

Figure 62 is a box plot comparing Decorative and Non-Decorative TTS against Marital Composition. The result offered support for the Social Hypothesis, which suggested that polygynous societies will tend to have more decorative clothing. That effect was not present for Non-Decorative TTS (a slight inverse relationship was shown instead).

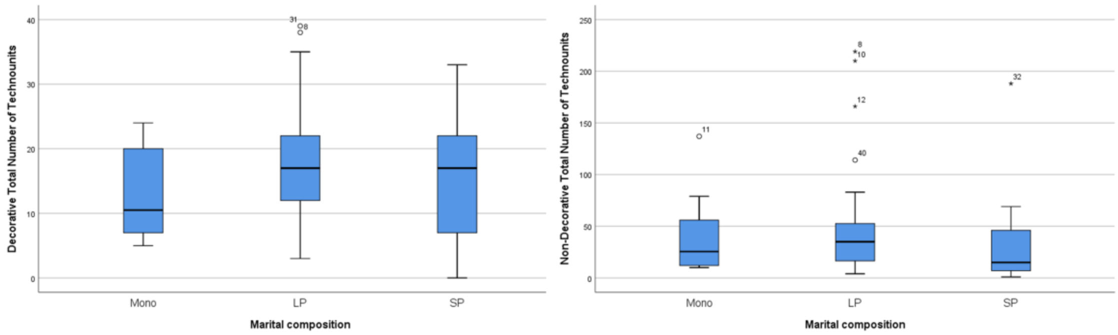

Figure 62: Box plot depicting the relationships between Decorative Total Number of Technounits, Non-Decorative Total Number of Technounits, and categorical variable Marital Composition: Monogamous (Mono), Limited Polygynous (LP), and Strongly Polygynous (SP).

Figures 63 and 64 show box plots of both Decorative and Non-Decorative TTS against Ingroup and Outgroup Violence respectively. Figure 45 suggests that there may be a slight tendency toward societies with ingroup violence having a greater number of both Decorative and Non-Decorative TTS. That result did not support the Social Hypothesis, which suggested such a relationship should not exist. The result that more warlike societies employ more Decorative TTS, on the other hand, was predicted by the Social Hypothesis. However, the result that suggested such societies also employed more Non-Decorative TTS as well was a surprise.

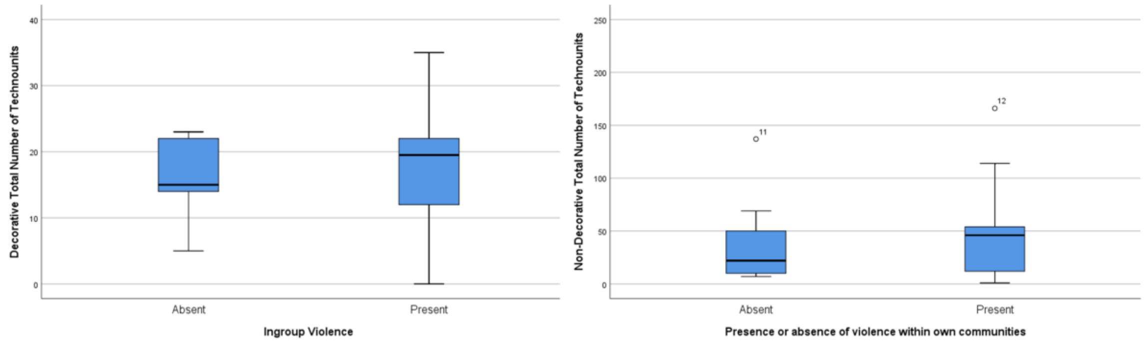

Figure 63: Decorative Total Number of Technounits and Total Number of Non-Decorative Technounits plotted against the categorical variable Ingroup Violence.

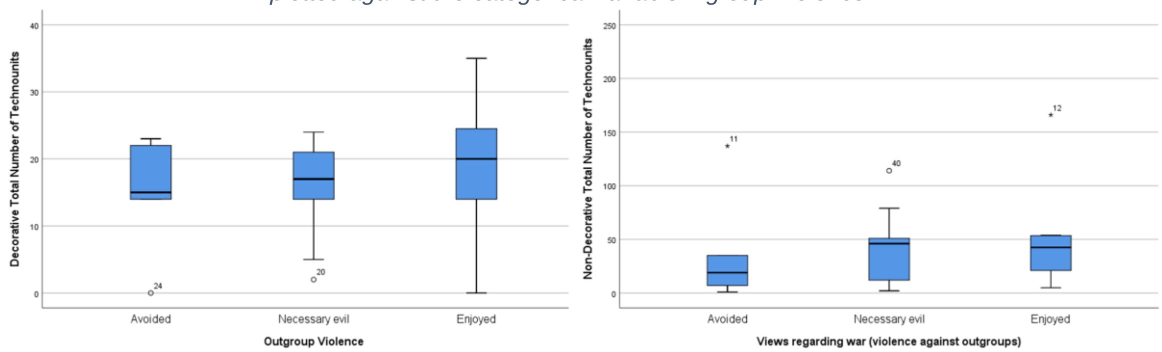

Figure 64: Decorative Total Number of Technounits and Total Number of Non-Decorative Technounits plotted against the categorical variable Outgroup Violence.

Figure 65 is a plot of Percentage of Decorative Technounits showing its relationships with the categorical variables Marital Composition, Ingroup Violence, and Outgroup Violence. The results suggested support for the Social Hypothesis that more polygynous societies would invest more into decorative clothing, although that pattern was only prominent with regard to wardrobe richness rather than individual clothing components. In contrast to the results seen with Percentage of Decorative Garments and its relationship with Outgroup Violence, the results did not support the Social Hypothesis that more warlike societies would invest relatively more in Decorative TTS. However, a similar pattern to the results seen with Percentage of Decorative Garments was notable with Ingroup Violence, which goes against the Social Hypothesis in that it predicts there should be no difference between hunter-gatherers practicing Ingroup Violence with regard to their investment in decorative clothing.

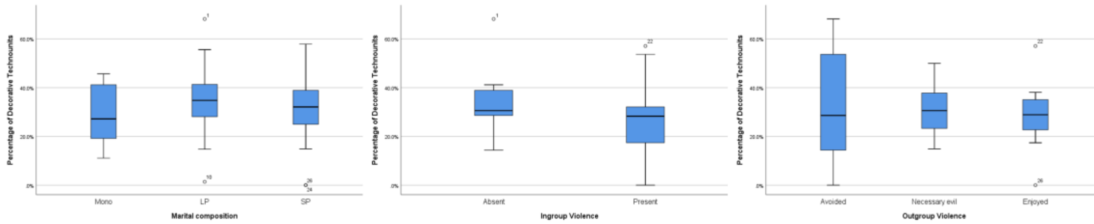

Figure 65: Percentage of Decorative Technounits; left to right: Marital Composition, Ingroup Violence, Outgroup Violence. Monogamous (Mono), Limited Polygynous (LP), and Strongly Polygynous (SP).

4.3.4.3. Average Number of Technounits per Garment

Figure 66 depicts the relationships between both Decorative AVE and Non-Decorative AVE and the social variables Sexual Dimorphism Index, Sexual Freedom Index-Male, and Sexual Freedom Index-Female. Decorative AVE was positively associated with Sexual Dimorphism Index and was negatively associated with Sexual Freedom Index-Male and Sexual Freedom Index-Female. Non-Decorative AVE has a similar relationship with the variables. These results are partially as-predicted by the Social Hypothesis: Sexual Dimorphism was predicted to be positively associated with Decorative TNG, but the Sexual Freedom Indices were predicted to be positively associated as well. These results are partially as-predicted by the Social Hypothesis: Sexual Dimorphism was predicted to be positively associated with Decorative TNG, but the Sexual Freedom Indices were predicted to be positively associated as well.

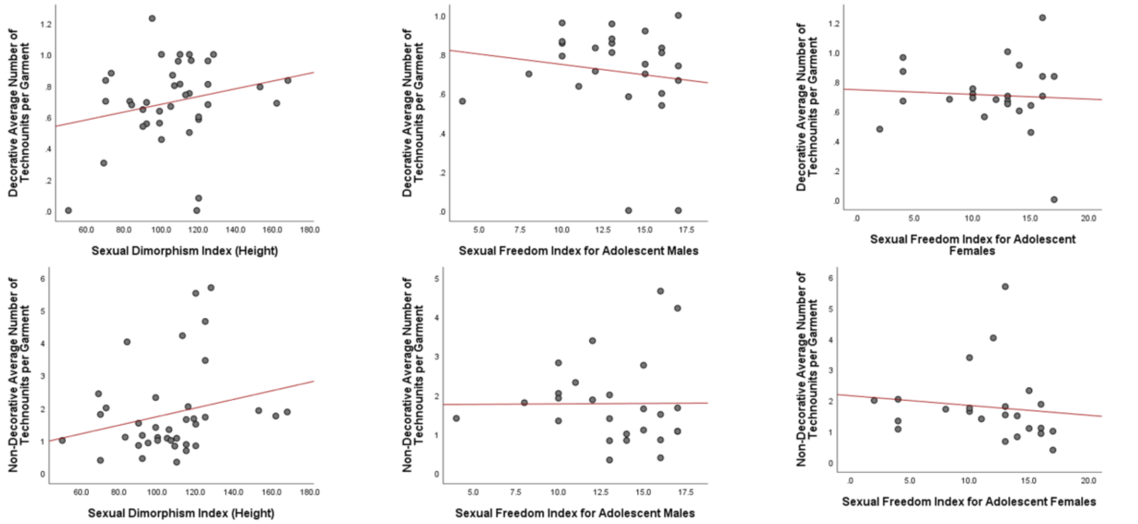

Figure 66: Top row: Decorative AVE and its associations with the social variables Sexual Dimorphism Index, Sexual Freedom Index-Male, and Sexual Freedom Index-Female. Bottom row: Non-Decorative AVE and its associations with the same three variables.

The results of the analyses in which both versions of AVE were regressed on the social variables are summarised in Table 42. For both versions of the clothing variable, none of the relationships with the social variables reached statistical significance.

*Table 42: Simple linear regression results for Decorative Average Number of Technounits per Garment (Decorative AVE) and Non-Decorative Average Number of Technounits per Garment (Non-Decorative AVE), along with the social variables. *Relationship is significant (2-tailed).*

	Sexual Dimorphism Index	Sexual Freedom Index-Male	Sexual Freedom Index-Female
Decorative AVE	r^2=0.025 p=.173	r^2=-0.021 p=.494	r^2=-0.044 p=.781
Non-Decorative AVE	r^2=0.057 p=.083	r^2=-0.042 p=.972	r^2=-0.032 p=.583

Figure 67 is a plot of Decorative and Non-Decorative AVE against Marital Composition. The results offered support for the hypothesis that more polygynous societies will tend to have more decorative components per garment. However, this signal did not extend to non-decorative components of garments. This result supports the Social Hypothesis, which suggests more polygynous societies would employ relatively more Decorative AVE.

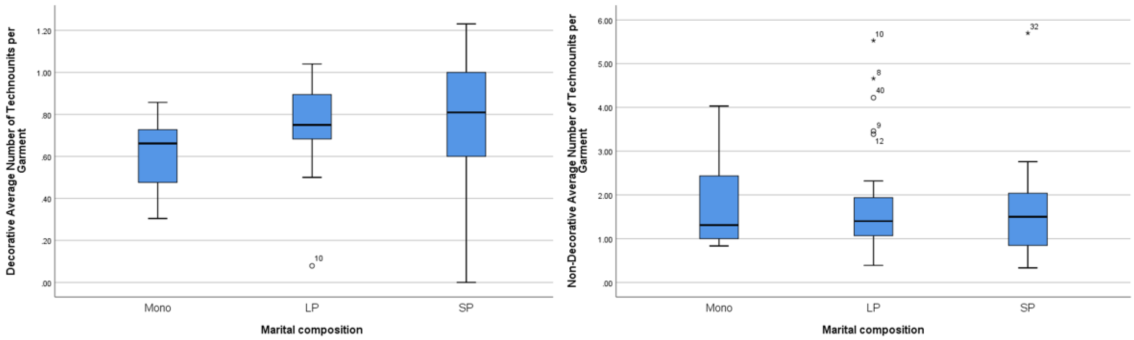

Figure 67: Box plots depicting the relationships between Decorative Average Number of Technounits, Non-Decorative Average Number of Technounits, and the categorical variable Marital Composition.

Figures 68 and 69 are plots of both Decorative and Non-Decorative AVE against Ingroup and Outgroup Violence, respectively. Figure 68 suggested a slight signal toward groups with ‘present’ Ingroup Violence having somewhat more complex garments. This result did not support the Social Hypothesis, which suggests no such relationship should exist. Figure 69 suggests that more warlike groups have a tendency toward more complex garments on average. That result is present for both Decorative and Non-Decorative AVE. This result supported the Social Hypothesis that more warlike societies ought to employ relatively more Decorative AVE. However, the result that suggested such societies also employed more Non-Decorative AVE was a surprise.

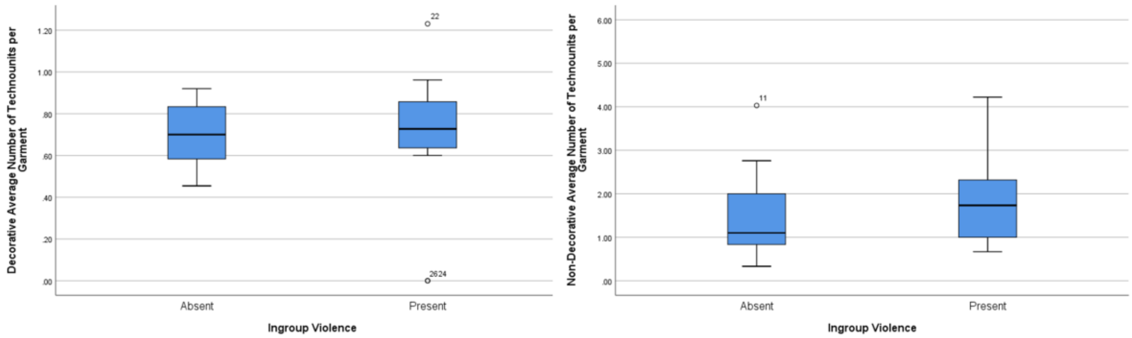

Figure 68: Box plots depicting the relationships between Decorative Average Number of Technounits, Non-Decorative Average Number of Technounits, and the categorical variable Ingroup Violence.

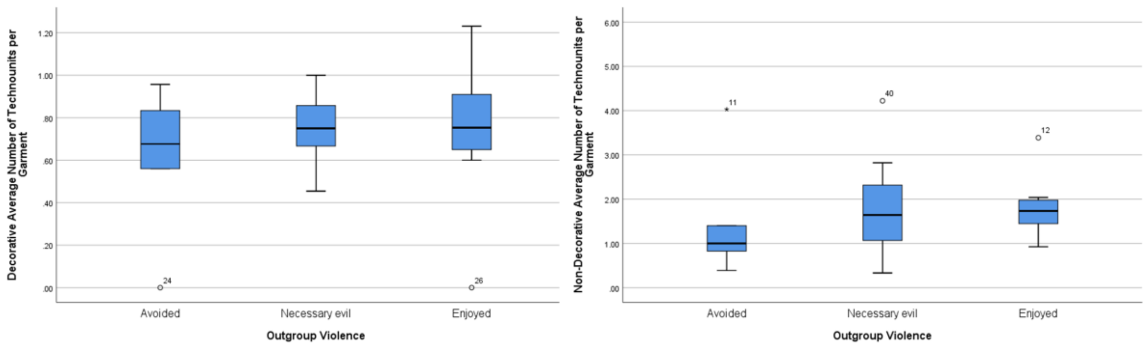

Figure 69: Box plots depicting the relationships between Decorative Average Number of Technounits, Non-Decorative Average Number of Technounits, and the categorical variable Ingroup Violence.

4.3.4.4. Summary of the results of the tests of the Social Hypothesis

In summary, none of the hypotheses related to Sexual Dimorphism Index or the Sexual Freedom Indices were strongly supported. However, there was strong support for the hypotheses that more warlike and more polygynous societies would be both more complex with regard to their decorative clothing in particular. The aspect of the Social Hypothesis that the presence of Ingroup Violence would positively correlate with wardrobe richness and complexity (particularly of decorative clothing) was partially **supported, since societies engaging in *less* Ingroup Violence tended to have relatively decorative clothing, but had less in terms of raw number of decorative garments and technounits**. Furthermore, there was support offered for the investment hypothesis (i.e., groups that are more polygynous and violent will invest relatively more in decorative clothing and clothing components). Of particular note is the result that more polygynous and more warlike societies richer and more complex Non-Decorative as well as Decorative TNG, TTS, and AVE. The Social Hypothesis did not predict that result.

4.3.5. Tests of the Population Hypothesis

4.3.5.1. Total Number of Garments

Figure 70 depicts the relationships between both Decorative and Non-Decorative TNG and the population variables Log10 Population Size, Log10 Population Density, and Maximum Aggregated Size. Decorative TNG was positively associated with Log10 Population Size, negatively associated with Log10 Population Density, and Maximum Aggregated Size returns an error result. These results supported the Population Hypothesis, which predicted that larger populations (and more aggregated ones) would invest more in Decorative TNG. Non-Decorative TNG was positively associated with Log10 Population Size, negatively associated with Log10 Population Density, and its association is slightly negative. These results are partially as predicted by the Population Hypothesis: larger populations were predicted to have more Non-Decorative TNG, but the same prediction was made for denser ones as well.

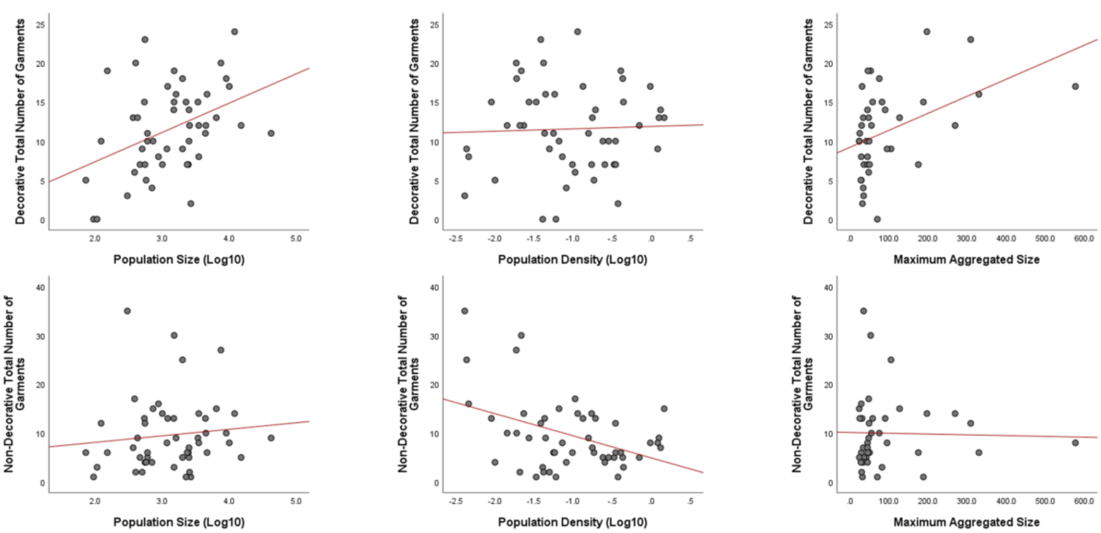

Figure 70: Top row: Scatter-plots showing the relationships between Decorative Total Number of Garments and its associations with the population variables. Bottom row: Scatter-plots showing the relationships between Non-Decorative Total Number of Garments and the same variables.

The results of the analyses in which both Decorative and Non-Decorative TNG are summarised in Table 43. For Decorative TNG, two of the three associations were statistically significant. Those two are Log10 Population Size and Maximum Aggregated Size. For Non-Decorative TNG, only the relationship with Log10 Population Density reached statistical significance, and that relationship was not in the predicted direction.

*Table 43: Simple linear regression results for Decorative Total Number of Garments (Decorative TNG) and Non-Decorative Total Number of Garments (Non-Decorative TNG), along with the population variables. *Relationship is significant (2-tailed).*

	Log10 Population Size	**Log10 Population Density**	**Maximum Aggregated Size**
Decorative TNG	r^2=0.143 p=.004*	r^2=-0.019 p=.494	r^2=0.170 p=.005*
Non-Decorative TNG	r^2=-0.009 p=.450	r^2=0.154 p=.003*	r^2=-0.026 p=.885

The stepwise multiple regression analysis focused on Decorative TNG suggested that Maximum Aggregated Size was the only relevant predictor of Decorative TNG variation (adjusted-r^2 0.191, p=.005). This result is as predicted by the Population Hypothesis, which suggested a positive relationship between Maximum Aggregated Size and Decorative TNG. The stepwise multiple regression analysis focused on Non-Decorative TNG suggested that Log10 Population Density was the only relevant predictor of Non-Decorative TNG variation (adjusted-r^2 -0.178, p=.004). This result was not as predicted by the Population Hypothesis, which suggested denser populations should employ more garments generally, and more Non-Decorative TNG specifically.

4.3.5.2. Total Number of Technounits

Figure 71 depicts the relationships between Decorative and Non-Decorative TTS and the population variables Log10 Population Size, Log10 Population Density, and Maximum Aggregated Size. Decorative TTS was positively associated with Log10 Population Density and Maximum Aggregated Size, and was negatively associated with Log10 Population Density. These results supported the Population Hypothesis, which predicted that larger populations (and more aggregated ones) would invest more in Decorative TTS; however, the same prediction was made for denser populations as well. Non-Decorative TTS was positively associated with Log10 Population Size and Maximum Aggregated Size and negatively associated with Log10 Population Density. These results are partially as predicted by the Population Hypothesis: larger populations were predicted to have more Non-Decorative TTS, but the same prediction was made for denser ones as well.

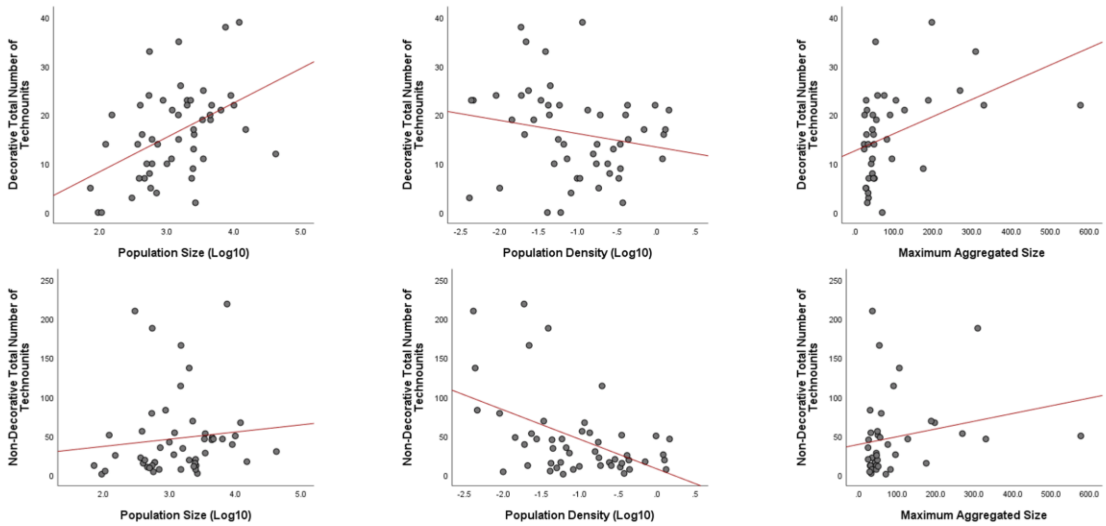

Figure 71: Scatter-plots showing the relationships between Decorative Total Number of Technounits and its associations with the population variables. Bottom row: Scatter-plots showing the relationships between Non-Decorative Total Number of Technounits and the same variables.

The results of the analyses in which both Decorative and Non-Decorative TTS are summarised in Table 44. For Decorative TTS, both Log10 Population Size and Maximum Aggregated Size showed statistically significant relationships. For Non-Decorative TTS, only its relationship with Log10 Population Density reached statistical significance.

*Table 44: Simple linear regression results for Decorative Total Number of Technounits (Decorative TTS) and Non-Decorative Total Number of Technounits (Non-Decorative TTS), along with the population variables. *Relationship is significant (2-tailed).*

	Log10 Population Size	Log10 Population Density	Maximum Aggregated Size
Decorative TTS	r^2=0.194 p=.001*	r^2=-0.019 p=.167	r^2=0.162 p=.006*
Non-Decorative TTS	r^2=-0.010 p=.468	r^2=0.217 p=.000*	r^2=0.021 p=.188

The multiple regression analysis focused on the Decorative TTS retained one predictor variable: Log10 Population Size (adjusted-r2 0.206, p=.002), accounting for 21% of the variation in Decorative TTS. This result is as predicted by the Population Hypothesis, which suggested larger populations would employ more Decorative TNG. The multiple regression analysis focused on Non-Decorative TTS retained two models. The first retained Log10 Population Density (adjusted-r2 -0.245, p=.001), and the second added Maximum Aggregated Size, for an adjusted-r2 of 0.305 (p=.001). Thus, Model 1 explained 25% of Non-Decorative TTS's variation, whereas Model 2 explained 31% of it. The models offered mixed support for the Population Hypothesis. Non-Decorative TTS was supposed to be positively associated with denser populations, which did not come to pass in the stepwise multiple regression analysis. However, Non-Decorative TTS were also predicted to be associated with more aggregated populations, which agrees with the result of the stepwise multiple regression analysis.

4.3.5.3. Average Number of Technounits per Garment

Figure 72 depicts the relationships between both Decorative and Non-Decorative AVE and the population variables Log10 Population Size, Log10 Population Density, and Maximum Aggregated Size. Average Decorative Technounits per Garment was positively associated with Log10 Population Density and Maximum Aggregated Size, and its relationship with Log10 Population Density was slightly positive. These results supported the Population Hypothesis, which predicted that larger populations (and more aggregated ones) would invest more in Decorative AVE. Non-Decorative AVE was positively associated with all three population variables. These results were as predicted by the Population Hypothesis: larger, denser populations are predicted to employ more Non-Decorative AVE.

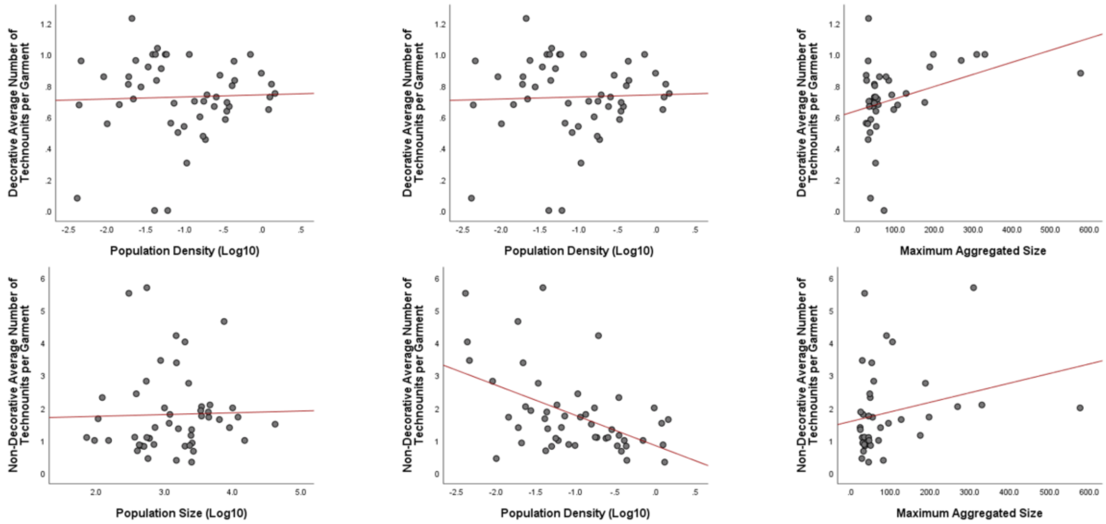

Figure 72: Top row: Scatter-plots showing the relationships between Decorative Average Number of Technounits and its associations with the population variables. Bottom row: Scatter-plots showing the relationships between Non-Decorative Average Number of Technounits and the same variables.

The results of the analyses in which both versions of Average Technounits per Garment were regressed on the social variables are summarised in Table 45. For Decorative AVE, statistically significant associations were present for Log10 Population Size and Maximum Aggregated Size. For Non-Decorative AVE, only Log10 Population Density reached statistical significance.

*Table 45: Simple linear regression results for Decorative Average Number of Technounits per Garment (Decorative AVE) and Non-Decorative Average Number of Technounits per Garment (Non-Decorative AVE), along with the population variables. *Relationship is significant*

	Log10 Population Size	**Log10 Population Density**	**Maximum Aggregated Size**
Decorative AVE	r^2=0.221 p=.000*	r^2=-0.020 p=.807	r^2=0.110 p=.022*
Non-Decorative AVE	r^2=-0.020 p=.858	r^2=0.232 p=.000*	r^2=0.039 p=.120

The multiple regression analysis focused on the Decorative AVE retained one predictor variable: Log10 Population Size (adjusted-r2 0.308, p=.000). This result is as predicted by the Population Hypothesis, which predicts that larger populations would have higher Decorative AVE. Log10 Population Size thus accounted for 31% of the variation in Decorative AVE. The latter multiple regression analysis, focused on Non-Decorative

AVE yielded two models. The first retained Log10 Population Density (adjusted-r2 0.244, p=.001), which explained 24% of the variance in Non-Decorative AVE. The second model added Maximum Aggregated Size (adjusted-r2 0.327, p=.000) and improves the predictive value of the independent variables to 33%. The models offered mixed support for the Population Hypothesis. Non-Decorative AVE was supposed to be positively associated with denser populations, which did not come to pass in the stepwise multiple regression analysis. However, Non-Decorative AVE were also predicted to be associated with more aggregated populations, which agrees with the result of the stepwise multiple regression analysis. Moreover, both multiple regression analysis supported the aspect of the Population Hypothesis that Non-Decorative AVE would be more strongly associated with Log10 Population Density than Decorative AVE would be.

4.3.5.4. Summary of the results of the tests of the Population Hypothesis

The results generally supported the Population Hypothesis insofar as it predicted that larger populations would employ more Decorative TNG, TTS, and AVE. However, Log10 Population Density did not conform to the predictions of the Population Hypothesis, which suggested that denser populations ought to employ more garments and components of either Decorative or Non-Decorative varieties. A relevant question to ask regarding these results is whether it is larger populations or simply more sedentary populations that employ more decorations. Or, stated differently, is sedentism downstream of population size, or vice versa?

Chapter 5. Discussion

In this section, I discuss the results and implications of my testing of environmental, economic, social, and population variables against Whole Wardrobe, decorative versus non-decorative clothing, and men's versus women's clothing variables. First, I summarise the results pertaining to each group of hypotheses. Next, I outline the limitations of my analyses. Lastly, I discuss the implications of my results and finish by pointing to future directions analyses such as those in this report can take.

5.1. RESULTS SUMMARY

5.1.1. Whole Wardrobe

When the Whole Wardrobe data were examined, several patterns emerged. First, and with regard to the original research question, which variables most strongly influence wardrobe richness and garment complexity?, Average Annual Temperature correlated so strongly with clothing complexity and wardrobe size that it was clearly the major environmental driver of variation in cross-cultural clothing complexity. Average Wind Chill and Peak Wind Chill integrated averages of temperature data (they are Average Wind Chill = hwc (33ºC-*T*air) and that equation applied to the three coldest months of the year respectively (Osczevski 1995), so much of Average Wind Chill and Peak Wind Chill's explanatory power was explained by Average Annual Temperature's. However, in many cases, Average Wind Chill and Peak Wind Chill improved upon Average Annual Temperature's strength as a predictor variable. That improvement suggested a specific role for wind chill and the particularly harsh conditions during the coldest months of the year in driving variation in cross-cultural clothing complexity. With regard to the differences between the clothing variables' associations with the environmental variables, it was notable that TNG had relatively weak relationships with all relevant environmental variables compared to TTS, AVE, and MNL. Therefore, variation in garment number was driven by more factors than was variation in the technounit-related variables.

Subsistence variables such as Percentage of Subsistence from Fishing, Percentage of Subsistence from Hunting, and Percentage of Subsistence from Gathering played only minor or no roles in influencing cross-cultural clothing complexity. Societies that tended to rely on gathering tended to wear less, and societies that tended to fish more tended to have a small number of specialised waterproofed garments. Societies relying more on hunting tended not to have more complex garments or rich wardrobes, defying initial predictions. Sexual Dimorphism Index may have played a minor role in shaping average garment complexity, though that signal and others related to social variables were weak and often were statistically insignificant. However, some social variables were more strongly predictive. Groups with more complex food storage techniques tended to have more complex clothing than groups with simpler ones, which may have had more to do with correlations between complex food storage and Average Annual Temperature than an effect of either on clothing design per se. Log10 Population Density had an inverse relationship with both TNG and with both TTS and AVE, but this relationship may simply be a reflection of the fact that more sparsely-populated areas tend to be colder, and thus the correlation may simply point to the previously-established fact that colder areas tend to lead to more complex clothing and richer wardrobes.

5.1.2. Inter-sexual differences in wardrobes and garments

When wardrobes were broken down along the lines of the sex of the wearer, some nuances were revealed. The clothing of men and women is largely similar, although men's clothing may be slightly more strongly influenced by environmental variables. Men's garments and technounits are also more numerous, but men's and women's garments are roughly equally complex.

Men's clothing was particularly strongly tied to decorativity (Decorative TNG, TTS, and AVE) and degree of polygyny (Marital Composition), suggesting that Marital Composition may influence men's behaviour to the degree that their societies have a strongly male-bias in decorative clothing variables (Decorative TNG, TTS, and AVE). Furthermore, more warlike societies (Outgroup Violence) had a strong tendency toward a male-bias in numbers of both decorative and non-decorative clothing. Groups practicing Ingroup Violence had a tendency toward having more Non-Decorative TNG, TTS, and AVE.

5.1.3. Decorative vs non-decorative elements of the wardrobe

The variation in complexity in decorative and non-decorative clothing was driven by very different factors. Environmental drivers such as Average Annual Temperature and Peak

Wind Chill exerted a much stronger influence on Non-Decorative TNG, TTS, and AVE than they did Decorative TNG, TTS, and AVE. Subsistence activities are weak predictors of variation in the complexity of either Decorative or Non-Decorative clothing variables, with the possible exception of Percentage of Subsistence from Gathering, which may have weakly influenced both decorative and non-decorative garment design and wardrobe complexity. There was a trend toward more sedentary societies having more complex decorative clothing (Decorative TTS, and AVE) and richer decorative wardrobes (Decorative TNG). Those data suggest that a people's carrying capacity constrains its abilities to move material culture over long distances, and that was particularly true of clothing components tied to signalling rather than to survival. Furthermore, that association suggests that larger, presumably more sedentary, populations may devote more energy to clothing aiding in social signalling. while societies with more advanced food storage techniques had more complex non-decorative clothing (Non-Decorative TNG, TTS, and AVE).

Societies with more positive views of violence toward outgroups had more complex decorative clothing (Decorative TNG, TTS, and AVE), while societies engaging in more ingroup violence (Ingroup Violence) had slightly more complex non-decorative clothing (Non-Decorative TNG, TTS, and AVE). More polygynous societies (particularly Strongly Polygynous in Marital Composition) tended to use relatively more decorative clothing (Decorative TNG, TTS, and AVE). Denser populations (Log10 Population Density) tended to have less complex non-decorative clothing (Non-Decorative TNG, TTS, and AVE). Larger populations (Log10 Population Size) tended to have more decorative garments and components (Decorative TNG, TTS, and AVE). Population size (Log10 Population Size) tended to correlate positively with richness of Decorative TNG and Decorative TTS/AVE.

5.2. IMPLICATIONS

In this section I discuss the implications of my results, starting with the Environmental Hypothesis, then moving on to the Economic Hypothesis, the Social Hypothesis, and finally the Population Hypothesis.

5.2.1. The Environmental Hypothesis

The following hypotheses were supported: that hunter-gatherers living in colder environments would have richer wardrobes, more layers, and more complex clothing; societies coping with the extremes of seasonal cold would have richer wardrobes and more complex garments; groups living in warmer environments would have more decorative clothing; Non-Decorative TNG, TTS, and AVE would be more strongly associated with environmental variables than the corresponding Decorative variables. The following five hypotheses were not supported: groups living in high-precipitation areas would have less rich wardrobes and less complex clothing; groups living in high-humidity areas would have less rich wardrobes and less complex garments; precipitation-related variables would have stronger associations with Non-Decorative TNG, TTS, and AVE than Decorative TNG, TTS, and AVE; and Male TNG, TTS, and AVE and Female TNG, TTS, and AVE would be equally correlated with precipitation-related variables. While some of the postulated directions of association were confirmed, statistical significance and strength of predictive power of the precipitation-related variables were so poor that they could not be regarded as supporting any particular hypothesis.

Depending on the clothing variable used, Average Annual Temperature explained anywhere from 47.4% (TNG) to 74.6% (AVE) of the variation in clothing complexity and wardrobe size. That degree of correlation was unsurprising due to the threats of hypothermia and other cold-related pathologies in frigid climates. Thus, clothing was necessary to allow humans to cope with those hazards. The ~30% gulf in Average Annual Temperature's explanatory power for differences in TNG and AVE was likely due to the greater need for high-latitude groups to have complex, tailored garments rather than many different, simpler garments. Low-latitude groups often have many simpler garments, few of which are designed to strongly shield wearers from the cold. Certain small-scale societies such as the Manus and Auin (San), who have a great many relatively simple garments, helped to decouple TNG from the environmental variables while having little effect on TTS and AVE.

While Average Annual Temperature often outperformed the two wind chill-related variables as a predictor of garment richness and complexity, Peak Wind Chill's relatively strong associations with clothing variables compared to Average Wind Chill's indicated that the extreme coldest points of the year have some specific influence on clothing design beyond day-to-day wind chill. It is likely that societies employing more fur trim (which adds to garment complexity) also experience the coldest wind chill (Peak Wind Chill). As previously mentioned, fur ruffs decrease heat transfer across the wearer's face by creating a stable, warm layer of air without impeding vision or movement. The larger the ruff, the better its performance is in terms of preventing both hypothermia and frostbite, especially in windy conditions that may lead to exposed skin drying and becoming poorly-supplied with blood (Cotel et al. 2004; Hassi and Makinen 2000; Moore and Semple 2011). While the majority of cold-weather clothing seems designed primarily to prevent hypothermia, fur ruffs, gloves, and mittens, are designed largely for frostbite-prevention given their high levels of protection of frostbite-prone areas. Therefore, the additional technounits (and garments) dedicated to frostbite-prevention in some of most extreme environments in the world likely explain Peak Wind Chill's outperformance of the other temperature metrics in some cases.

While it is unsurprising that Non-Decorative TNG, TTS, and AVE were more strongly associated with temperature-related variables than Decorative TNG, TTS, and AVE were, it is notable that the latter set of variables were nonetheless positively associated with temperature-related variables. Average Annual Temperature positively correlates with Percentage of Decorative Garments (11% variation predicted) and Percentage of Decorative Technounits (34% variation predicted). Therefore, groups living in warmer climates were demonstrated to have a slight tendency towards having higher TNG, TTS, and AVE. These associations suggested support for the notion that the human 'canvas size' (nakedness, essentially) for potential decorations is higher in societies employing less clothing. That possibility explains both Average Annual Temperature's influence on tendencies toward decorative signalling and the discrepancy between the more weakly-correlated Percentage of Decorative Garments and the more strongly-correlated Percentage of Decorative Technounits. On a naked human body, it stands to reason that covering it in decorations would increase counts of technounit-related variables such as TTS and AVE rather than TNG. It is tempting to suggest that hunter-gatherers in warmer areas simply have more available brightly-coloured items and pigments with which people can decorate themselves. However, birds, butterflies, and plants are more colourful further away from the equator (Dalrymple et al. 2015). Instead of animal and plant biomass being more colourful in lower latitudes, it may simply be that the potentially-decorative biomass is more common and thus, more commonly gathered. Moreover, it may instead be that hunter-gatherers in warmer areas are more sedentary and have higher populations, therefore increasing carrying capacity for signalling-related garments and components. When Distance Moved Yearly (km) is regressed on Average Annual Temperature, an adjusted-r^2 of 0.112 (p=.024) is found, thus supporting the explanation of the link between sedentism and temperature. However, when hunter-gatherers were binned into ‘Mobile’ and ‘Sedentary’ categories, the mean difference between the categories was hardly different when compared to Average Annual Temperature. When Log10 Population Size is regressed on Average Annual Temperature, an adjusted-r^2 of .037 (p=.096) was the result. Therefore, the capacity for warmer (more decoratively-inclined) societies for carrying biomass used for decoration is likely not higher. The associations between Percentage of Decorative Garments and Percentage of Decorative Technounits and Average Annual Temperature are likely better explained by the relative abundance of potentially-decorative biomass closer to the equator regardless of that biomass not being relatively more colourful compared to more northerly biomass.

MNL provided an opportunity for being tested separately against nLaittude due to the potential for understanding whether (or at what point) layers become more important than single, complex garments. One layer of clothing provides as much as one clo of insulation (Churchill 2014), so it was expected that layering would be relatively unimportant at lower latitudes. This section uses a modified version of latitude called nLatitude. nLatitude is normalised latitude, and aggregates North and South latitudes around the same numerical designations.

The relationship between latitude and layering was curvilinear (Figure 73). When hunter-gatherers are separated into latitudinal bands, was evident that layering becomes important around 40° nLatitude—lower than expected. There is a second, additional launch point at which layering becomes much more important above 60° nLatitude after a seeming stabilisation of importance between 50° and 60° nLatitude. It may be that the two-stage increase in the importance of layers is simply a matter of additional layers being used to keep people warm above a certain critical latitude. Another possibility is that the increase in layering at lower latitudes is associated primarily with keeping precipitation out, whereas the increase in layering represented by second jump is due more to trapping warm air close to the skin. The latter possibility entails fundamental design differences that render layering more complex than simply being a mechanism to trap warm air close to the skin. Neither possibility is mutually exclusive, and lower-latitude societies sometimes do employ multiple layers, presumably for warmth, and mid-latitude groups do often employ specialised rain gear. Nonetheless, rain gear is often only one layer, implying perhaps that, while the association between layers and latitude is not linear, the drastic jumps in layering's importance are mostly to do with ambient temperature rather than precipitation. The relatively weak association between precipitation-related variables and the clothing variables was strongly suggestive of the former's lack of importance.

Because the use of multiple layers was tightly associated with Average Annual Temperature, similar to the manner in which TTS and AVE were (Figure 74), the use of complex individual garments and multiple layers of simpler garments can likely be seen as complementary, rather than competing, strategies. The use of multiple, simple layers allows air trapped between them to remain warm, thus warming the wearer, while highly complex but permeable outer garments curb the deleterious effects of wind chill and prevent sweat absorption from undermining insulation capabilities (Gilligan 2010a). Nonetheless, the notion that layers may be employed at mid-latitudes specifically to keep moisture out begs more analysis.

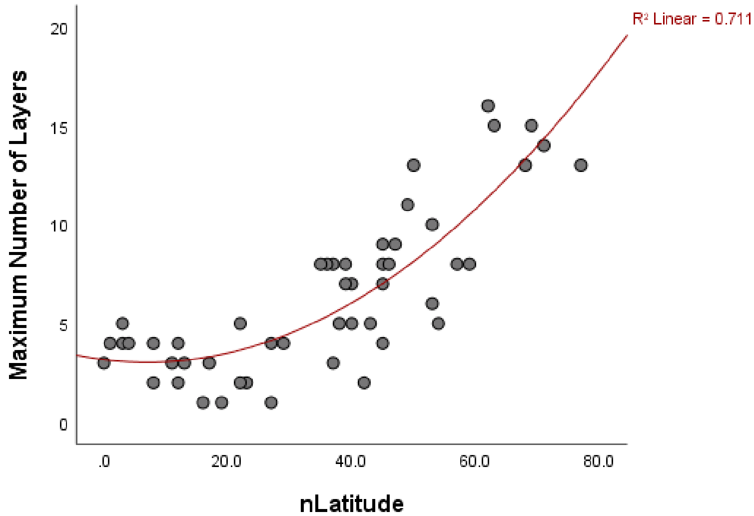

Figure 73: Layers vs. normalised Latitude. Note the "take-off" point of the importance of layering around 40°. Also of note is the curvilinear relationship between nLatitude and Maximum Number of Layers.

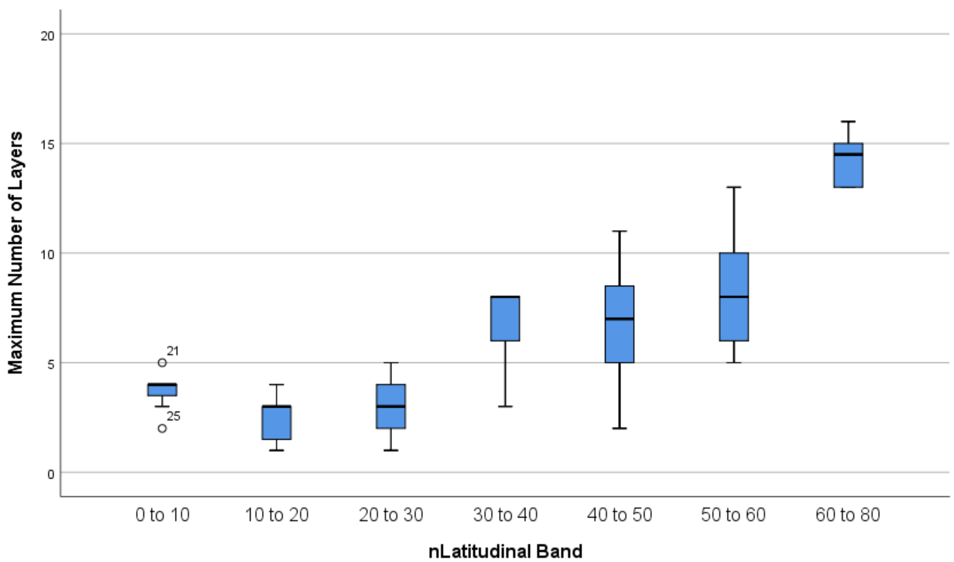

Figure 74: Layers vs. normalised Latitude by group. Contrary to Figure 70, this figure suggests two jumps in importance of layering: above 30° nLatitude and again above 50°.

5.2.2. The Economic Hypothesis

The lack of associations between Percentage of Subsistence from Hunting and TNG, TTS, and AVE suggested little support for the hypotheses that both subsistence strategies should lead to richer wardrobes and more complex clothing. However, while Percentage of Subsistence from Hunting offered no association, Percentage of Subsistence from Fishing had weak relationships with TNG and TTS, suggesting some hypotheses support (but stepwise multiple regression analysis suggested no role for Percentage of Subsistence from Fishing). The negative and significant associations between Percentage of Subsistence from Gathering and garment richness/clothing complexity (borne out by both linear regression and multiple regression analysis) suggested support for the hypothesis that cultures relying more on gathering would have less rich wardrobes and less complex garments. Furthermore, groups for whom gathering provides the majority or a significant plurality of caloric needs tend to live in relatively warm climates, and they therefore would have less complex clothing regardless of subsistence strategies since the main predicting variables for TNG, TTS, and AVE are environmental rather than economic. Across a wide geographical sample, hunting does not specifically require many different or complex garments, regardless of ranging behaviour. Groups that have the most complex garments usually live at high latitudes, and many of them live in relatively close proximity to major waterways, suggesting a reliance on fishing.

The hypothesised difference between men's and women's clothing in relation to subsistence activities was only partially supported in spite of strong ethnographically-documented evidence for men's greater role in riskier subsistence activities (Ember 1978) and assumed need to range further for hunting and fishing, which is a pattern evident for certain hunter-gatherers operating today such as the Hadza (Pontzer 2012). Gathering—a task more often performed by women (DeVore and Konnor 1974), and in this analysis serving as a proxy for subsistence activity not derived from hunting and fishing—has a consistent enough inverse association with TNG, TTS, and AVE that it may predict around 30% of clothing variation. It is likely that despite men doing the lion's share of fishing, the number of cultures needing waterproofed fishing garments (and the number of such garments themselves) was low enough that it did not affect the associations in the sample nearly to the degree that gathering did. It is also likely that men's more variable roles as high-risk fishers, shamans, and warriors require that they have higher TNG and TTS, but a similar AVE to women.

With regard to explaining the gulf between men's and women's clothing, men's clothing has more TTS largely because men have more garments than women do. Male AVE, however, does not fit that pattern. The difference in the means of Male and Female AVEs are minor, suggesting similar average garment complexity. Furthermore, Female AVE is more strongly associated with Average Annual Temperature (male adj-r^2

suggests that Average Annual Temperature explains 54% of Male AVE and 61.1% of Female AVE). Waterproofed garments are usually no more complex in terms of average technounits than non-waterproofed ones. They are simply made of different materials (Holtved 1967; Jochelson 1908; Murdoch 1892; Osgood 1940) This means that a small number of garments and technounits are added to men's wardrobes in some societies, but AVE remains relatively consistent between the sexes despite differentiated subsistence activities. Since hunting and fishing themselves do not seem to be strongly correlated with clothing complexity—and do not exert differential effects on men's and women's clothing, the gulf in men's and women's clothes was not able to be explained by economic variables.

The major differences in numbers of Male TNG and TTS compared to Female TNG and TTS compared to the minor difference between either sex's AVEs combined with the aforementioned stronger association between Female AVE and environmental variables related to cold temperatures may be due to a few factors. While it is possible that women's lower relative Basal Energy Expenditure (BEE) (Frankenfield et al. 1998 account for their slightly higher AVE, the gulf between non-obese men's (1635kcal) and women's (1323kcal) is much larger than the differences in Male (mean 2.62) and Female (mean 2.55) AVEs would suggest were metabolism a constraint on clothing design. Thus, there was little evidence to suggest that garment complexity is tied to metabolism. The gulf between the Male and Female TNG/TTS differences and Male and Female AVE differences may be due to the fact that there are several examples of women's garments being the most complex individual garments in several societies, and many of these garments' technounits are dedicated to carrying babies (pouches, straps, etc.). Furthermore, even in areas of garment types presumably neutral to sex-based role differences, some women's garments have fundamental design differences that increase their count of technounits. Hoods are the most prominent example of this phenomenon (Holtved 1967).

There was support for the hypotheses that the clothing variables would be positively associated with more complex Food Storage; that hunter-gatherer sedentism would correlate positively with the clothing variables; and that more complex Food Storage strategies would be positively associated and degree of Mobility would be equally associated with men's and women's clothing. The hypothesis that Mobility would be correlated with Decorative and Non-Decorative TNG, TTS, and AVE equally was not supported.

Groups with more complex food storage strategies tend to have more complex general material culture (Testart et al. 1982). That complexity is reflected in societies' clothing as well, as this study detected a moderately strong signal that societies with more complex food storage strategies also had higher Non-Decorative TNG, TTS, and AVE values, but not the Decorative versions of those variables. On the other hand, more sedentary societies tended to have higher Decorative TNG and TTS values but not the Non-Decorative versions of those variables.

Food Storage is strongly associated only with Non-Decorative TNG, TTS, and AVE. Although relatively mobile and relatively sedentary groups have large differences in toolkit complexity and other types of material culture (Testart et al. 1982)—that complexity perhaps being an influencing factor in tendencies toward sedentism (de Saulieu and Testart 2015)—the difference in overall clothing complexity between mobile and relatively sedentary groups is small, and is not evident in AVE. The incongruence between the general pattern of sedentary groups having more complex general material culture and sedentary groups having only marginally more complex clothing suggests that clothing requires far greater complexity to aid in survival than other forms of material culture. Sedentary societies have a strong tendency to have more higher Decorative TNG and TTS, but little difference in Decorative AVE. It is possible that sedentary societies simply have larger carrying capacities and therefore they can devote more energy to making transporting clothing dedicated purely to social signalling instead of decorative augments to larger garments.

While there was a slight link between degree of sedentism and more complex clothing and a reasonably strong one between more complex food storage strategies and complex clothing, the variables are likely driven by the same underlying factors. More sedentary societies tend to have more complex food storage strategies—one tends to entail the other—(Howey and Frederick 2016), perhaps as a means to reduce the risk of resource failure (Testart 1982). Instead of food storage strategies and sedentism driving complex clothing directly, it is likely that there are other drivers influencing clothing complexity, sedentism, and food storage strategies concurrently. It may simply be that societies living in the harshest cold environments have more complex clothing and more opportunities to store food for long periods of time, irrespective of their need to be mobile, which instead may be driven more by local resource stability (or instability).

5.2.3. The Social Hypothesis

The hypothesis that polygynous societies would have higher Decorative TNG, TTS, and AVE than monogamous societies was supported, and the positive association between polygyny and Decorative TNG, TTS, and AVE is particularly true of Strongly Polygynous hunter-gatherers. The hypothesis that there will be a skew toward male decorativity in more polygynous societies was confirmed: men tend to be more inclined to decorate their clothing than women, in a cross-cultural sample. However, one anomalous result is that there is a simultaneously male-bias in decorative clothing in polygynous societies and a male-bias in non-decorative clothing in monogamous ones. The hypothesis that men in more warlike societies will employ more Decorative TNG, TTS, and AVE than men in less warlike societies is confirmed.

Monogamous societies had the smallest number of Decorative TNG, TTS, and AVE. Limited Polygynous societies had more than Monogamous ones, and Strongly Polygynous groups had the most. That pattern was true of both raw totals and percentages, with TNG, TTS, AVE and Percentage of Decorative Garments and Percentage of Decorative Technounits supporting that hypothesis.

With regard to the second hypothesis, the increased use of decoration in polygynous societies was particularly true for men. Both Percentage of Decorative Garments and Percentage of Decorative Technounits had an inter-gender discrepancy, though the former's was greater. Two conclusions can be drawn. First, the more polygynous a society is, the greater the male-bias in their decorative clothing. Second, male-female gulf in decorativity between Percentage of Decorative Garments and Percentage of Decorative Technounits (the former having had a greater male bias) suggests that men may not necessarily employ highly complex decorative clothing in all circumstances, but may simply use many smaller and simpler decorations in a less ostentatious manner.

The most interesting conclusion drawn from these data is not that polygynous societies are more inclined to use decorative clothing than are monogamous ones, but that men in polygynous societies likely engage in certain aspects of display behaviour more frequently and more flamboyantly than women. The difference in the sexes' use of decorative clothing is likely an expression of effective female scarcity due to their being monopolised by relatively few men in polygynous societies—especially Strongly Polygynous ones. A biased OSR is an important factor in determining degree of intra-sexual competition for mates (Weir et al. 2011) and is a pattern that holds for non-primate animals (Berglund 1994; Jirotkul 1999), non-human primates (Mitani et al. 1996), and in humans (Marlowe and Berbesque 2012). A male-biased OSR, ubiquitous to one degree or another in polygynous societies, necessitates increased competition among men for an effectively scarce resource: women. Men, compelled to compete vociferously over slim pickings, decorate themselves to a degree less needed in monogamous societies. The male need to compete in such circumstances manifests more darkly as well: violence is more common in small-scale polygynous societies (Levinson 1989). Larger-scale polygynous societies are also noted as generally more violent both in terms of male-male and male-female violence (McDermott and Cowden 2018; Wilson and Daly 1985). However, polygyny need not be a perfect proxy for competition and inequality. There seems to be a tipping point past which largely-monogamous, agricultural societies experience greater wealth inequality than smaller-scale agricultural and hunter-gatherer groups do, even when the latter are polygynous (Ross et al. 2018). Higher-resolution data would be needed to examine whether the societies in this study experience wealth inequality and competition among the aforementioned lines or in lockstep with traditional modeling holding polygyny as a strong marker of general inequality (of wives, wealth, etc.) and as a factor pressuring men in polygynous societies to compete with one another (Sanderson 2001).

Human females in large-scale societies perceive males as being more attractive in the presence of luxury goods such as expensive cars, furniture, and clothing (Dunn and Hill 2014). In small-scale societies, garments may be one of the few means of visually boosting one's status, and in polygynous societies, clothing could act as a battleground upon which conspicuous competition plays out. It bears questioning whether the use of clothing for that sort of competition acts to attenuate or amplify levels of male-male violence in societies. If clothing acts to attenuate male-male violence, then the most decoratively-inclined polygynous groups ought to be the least violent, and the least decoratively-inclined polygynous groups ought to be the most violent. Therefore, it is reasonable to conclude that particularly for men in polygynous societies, clothing and jewelry are overt means of expressing worthiness to potential mates. It is likely, however, that more polygynous societies tend to be more violent ones, which suggests either that decorative clothing does not attenuate men's propensity toward violence in those societies or that any attenuation is far weaker than the need to compete over scarce women.

There was support for the hypothesis that men in societies with more positive views toward Outgroup Violence, but that support must be qualified: more warlike societies have both higher Decorative and Non-Decorative TNG, TTS, and AVE. The hypothesis that more warlike (by measure of tolerance of Outgroup Violence) societies would have a male-skew in decorative clothing was supported. The hypothesis that Ingroup Violence would not be associated with clothing variables in any direction was not supported: societies with more Ingroup Violence tend to have more Non-Decorative TNG, TTS, and AVE.

The evidence for the first hypothesis suggested that more warlike societies have more complex clothing of both decorative and non-decorative varieties. It stands to reason that more warlike hunter-gatherers likely have more complex material culture more generally. Such groups would likely often have weapons dedicated solely to wounding and killing opponents. Their having more decorative clothing (demonstrated via higher Decorative TNG, TTS, and AVE) was explicable due to more warlike societies needing more decorations to show off the prowess of their warriors and/or intimidate their enemies. The second aspect of the results was less explicable. Since armour does not play a role in this study (which may otherwise explain that result), other avenues for explanation are needed. More warlike societies having more Non-Decorative TNG, TTS, and AVE may indicate that they engage in economics in a more wasteful manner and thus create more clothing—perhaps unnecessarily. There may be other variables that influence that result. It would be worth testing whether or not more warlike societies tend to exist at higher latitudes, and therefore the fact that they employ more clothing is downstream of environmental conditions. It may also be worth testing whether more warlike societies are more polygynous. If so, the pattern of both Decorative and Non-Decorative clothing being richer and more numerous may be an effect of polygyny rather than warlikeness per se.

The second hypothesis had a simple explanation, and is downstream of the explanation for the data related to the first hypothesis. Warmaking is a typically male activity, and as a corollary, women are often peace delegates in hunter-gatherer societies (Wrangham and Glowacki 2012). Because men take up the role as warriors and soldiers in most societies most of the time, that burden must is expressed via their material culture. One example of that material culture is decorative clothing, which can act a series of tools used to compete with men both within and without their own societies.

With regard to the third hypothesis, the presence of Ingroup Violence (taken to primarily mean domestic violence) was positively associated with TNG, TTS, and AVE in general, but was specifically associated with Non-Decorative TNG, TTS, and AVE. Furthermore, the absence of ingroup violence was positively correlated with Percentage of Decorative Garments and Technounits. This result was partially surprising. It may simply be that more warlike societies tend also to be more violent within their own communities as well. If true, it may be that that male-male competition, perhaps the driving force behind the degree to which a society invests in decoration, is tied more to war than it is to violence within its own communities. If the association between warlikeness and Ingroup Violence is present, then it can be said that violent societies have more complex Decorative and Non-Decorative TNG, TTS, and AVE. Other variables such as Marital Composition may come into play in the case of Ingroup Violence as well. It is possible that polygynous societies have more complex clothing and richer wardrobes (of both decorative and non-decorative varieties), and those societies happen to be more violent. Again, however, that does not truly answer the question at hand. It may be that in polygynous societies and violent societies (and especially both), there is a great deal of pressure to compete with one another, and therefore, clothing offers a means of non-violent (but perhaps violence-adjacent) competition.

As a means of understanding the relationships between social variables and male-skew of decorative garments, I synthesised the Decorative/Non-Decorative and Male/Female variables. Figure 75 is a series of plots comparing the categorical variables Marital Composition, Ingroup Violence, and Outgroup Violence to the male-bias of both decorative and non-decorative garments. There are several notable results. First, the male-bias of garments applies to decorative garments but not to non-decorative ones when the categorical variable is Outgroup Violence. Second, the male-bias of garments applies differentially to decorative and non-decorative garments when compared to

Ingroup Violence. There is a male-bias in decorative clothing in groups for whom ingroup violence is absent. In contrast, there is a male-bias in non-decorative clothing in groups for whom ingroup violence is present. Third, there is no male-bias in non-decorative clothing when the societies are grouped by marital composition. However, there is a male-bias in decorative garments in monogamous societies compared to more polygynous ones.

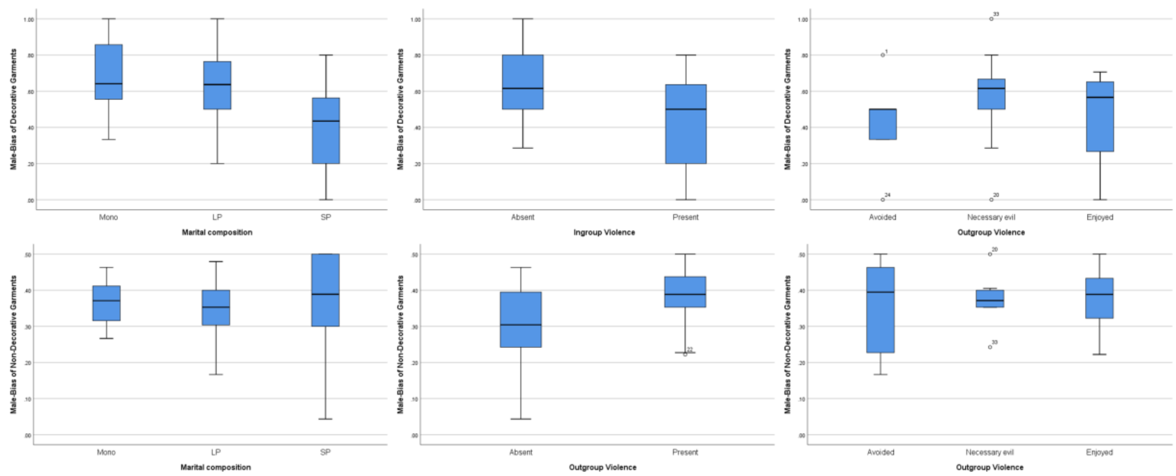

Figure 75: Scatter-plots showing the male-bias of Decorative and Non-Decorative Total Number of Garments plotted against Marital Composition (left), Ingroup violence (middle), and Outgroup Violence (right). Top row: male-bias in decorative garments. Bottom row: male-bias in Non-Decorative Garments. Both dependent variables are composed of the percentage of male and unisex share divided by the total number of decorative or non-decorative garments in the Whole Wardrobe. Monogamous (Mono), Limited Polygynous (LP), and Strongly Polygynous (SP).

Figure 76 is a series of plots akin to Figure 75, except that the dependent variable is the male-bias in decorative technounits rather than garments. With regard to Outgroup Violence, the results suggest a sharp division between decorative and non-decorative technounits. More warlike groups have a strongly male-bias in their decorative technounits but not their non-decorative ones. With regard to Ingroup Violence, there is a significant male-bias toward non-violent groups with regard to decorative technounits, but not non-decorative technounits. There is a slight bias against male-dominated non-decorative technounits in more polygynous societies, but the pattern is inverted with decorative technounits. For decorative technounits, more polygynous societies tend to have a male-bias in their decorative technounits. Taking Figures 75 and 76 together, there was support for the hypotheses that more warlike societies tend to have a male bias in decorative but not non-decorative technounits and decorative garments. Furthermore, there was support for the hypothesis that more polygynous groups have a similar male bias.

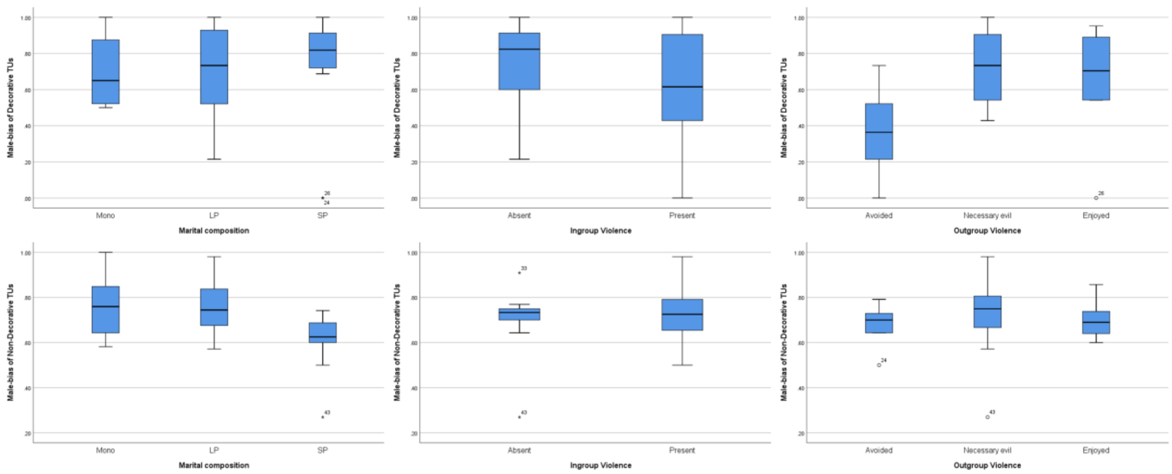

Figure 76: Scatter-plot showing the Male-bias of Decorative and Non-Decorative Total Number of Technounits and against Marital Composition (left), Ingroup violence (middle), and Outgroup Violence (right). Top row: male-bias in decorative garments. Bottom row: male-bias in non-decorative garments. Both dependent variables are composed of the percentage of male and unisex share divided by the total number of decorative or non-decorative technounits in the Whole Wardrobe. Monogamous (Mono), Limited Polygynous (LP), and Strongly Polygynous (SP).

While the hypothesis that Sexual Dimorphism Index is positively associated with wardrobe richness and garment complexity may have some limited support, the predictive value of Sexual Dimorphism Index, Sexual Freedom Index-Male, and Sexual Freedom Index-Female are so poor that none of the hypotheses can be regarded as truly supported. Stepwise multiple regression analysis indicated little predictive power for Sexual Dimorphism Index and either SFI, though in a limited sense, Sexual Dimorphism Index may be predictive of some aspects of decorative dress.

As discussed earlier, increased sexual dimorphism is associated with greater degrees of polygyny (Mitani et al. 1996), and societies living in warmer climates have a slight tendency to be more inclined to dress decoratively than those in colder ones. The latter tendency may be in part to do with the fact that, in broad terms, monogamy is more strongly associated with higher-latitude, agricultural societies and polygyny lower-latitude hunter-gatherers (https://d-place.org/parameters/EA009). Hunter-gatherers living at lower latitudes may be more inclined toward polygyny, may be more sexually dimorphic, and therefore may be more inclined toward decorative dress. Therefore, hunter-gatherers in warmer areas must use more decorations to advertise their availability.

Another possibility that may explain hunter-gatherer decorativity in warmer climates is hormonal: humans in colder environments, at least under physical exertion, tend to have higher average testosterone levels than groups in warmer environments (McConnell and Sinning 1984). It is unclear if this difference holds for non-exercising humans. Furthermore, there is evidence from birds that exogenous and endogamous testosterone not only correlates with polygyny, but seems to induce the behaviour (Wada et al. 1999; Wingfield 1984), and this pattern of increased polygyny correlating positively with testosterone is present in at least some mammals as well (Negro et al. 2010). If the temperature division for human testosterone levels holds consistently and is a factor outside of exercise, one would predict that testosterone levels will correlate negatively with Average Annual Temperature. If true, one would expect increased investment in decorations at higher latitudes; however, as demonstrated, the inverse is true.

More polygynous activities and therefore more male-male competition potentially correlating positively with higher testosterone levels may be at odds with the reality of worldwide distributions of marital systems. Polygyny is not normally distributed across the globe, and monogamy is more common at lower latitudes. Therefore, we are left with a puzzle that, in warmer environments, societies invest more in decorative clothing, but are *more* monogamous, may have lower testosterone levels (though this point is tentative), and engage in less warfare and less ingroup violence.

5.2.4. The Population Hypothesis

While some of the directions of relationships were as predicted, the significance of those relationships is questionable. In many cases, while the results were found to be statistically significant, their practical significance is limited due to the weak associations. The hypothesis that wardrobe richness and garment complexity will be positively associated with Log10 Population Size and Maximum Aggregated Size was partly supported. The hypothesis that wardrobe richness and garment complexity would be positively correlated with Log10 Population Density (strongly enough to counter the environmental influences on complex clothing) was refuted. The hypothesis that wardrobe richness and garment complexity would be equally associated with Decorative TNG, TTS, and AVE and Non-Decorative TNG, TTS, and AVE is unsupported. A contrary result was found.

Some primary support for hunter-gatherer clothing conforming to the population size hypothesis (Henrich 2004) was evident. Log10 Population Size predicted around 9% of the variation in Whole Wardrobe TNG, at a statistically significant level (p=.019). However, much of that association is due to Log10 Population Size's differential predictive strength for Decorative TNG (14% predicted, p=.004) and Non-Decorative TNG (no predictive strength—and similar results are evident for TTS and AVE). It may be that the population size hypothesis applies very narrowly with regard to clothing. It is possible that larger populations devote more energy toward decorative garments and garment components than smaller ones due to increased levels of competition in larger groupings. However, that explanation is at odds with data suggesting that larger organisations of people are under less selection pressure than are smaller ones (Barnett and Amburgey 1989). It may instead be that larger populations have more complex socioeconomic structures that encourage the manufacture and sale or trade of decorative clothing. While the suggestion that larger populations have relatively complex socioeconomic structures has some support, there is evidence that those same structures are spawned in large part due to intense selection pressures downstream of relatively large, dense populations (Keeley 1988b). It may simply be that larger populations can devote more time and energy to the manufacture of non-survival clothing, and therefore Decorative TNG, TTS, and AVE are perhaps slightly higher in those societies. The hypothesis that higher Log10 Population Density would lead to more complex clothing and richer wardrobes was refuted simply because of the strength of environmental predictors of clothing complexity playing such large roles in shaping clothing.

5.3. LIMITATIONS

With regard to the fundamental methodology of the study—the quantification of wardrobes—this study did not assume that Oswalt's system of quantifying material culture via technounits was the only way to understand or quantify clothing. It was, however, an attempt to apply a method of analysis that is simple, intuitive, and generalisable to all clothing across all cultures. The method did necessarily aim to shed light on the relative importance of garments or their components. Oswalt's method was a means to understand clothing complexity rather than the significance of particular pieces of material culture.

This study assumed not only that ethnographers did not intentionally omit data pertaining to the cultures they studied, but also that they made comprehensive and honest depictions of garments and their use. Nonetheless, certain items may have been missed by ethnographers and were never recorded by them. Moreover, I may have missed some items during my data collection. Such errors were likely randomly distributed throughout my sample. Errors and omissions by ethnographers were likely rare, especially with regard to material culture as visible as clothing.

Some aspects of clothing would have been difficult for me to describe due to inherent ethnographic limitations. My following Oswalt (1987)'s combination of all stitching on any garment into a single technounit exemplifies that difficulty. Like Oswalt, I aimed to minimise the risk of miscounting stitches. Shirts most often have underarm stitching, stitching to attach sleeve panels, and stitching to attach sleeves to the body of the shirt. However, because some examples of shirts may have hidden stitching, unreported by ethnographers, this study followed Oswalt (1987) and erred on the side of caution.

Certain types of dress were designed to be discreet. Masks and similar items, such as those used extensively on the Pacific Northwest coast, were not only highly variable in manufacture, but were usually meant only to be seen by a select group of people within those cultures—irrespective of Westerners' later scrambles to sell or otherwise purge those forms of material and intellectual culture (Cole 1995). Masks such as those used by the Patagonian Selk'nam (Ona) and Yaghan (Lothrop 1928), were used in secret society contexts similar to those on the Pacific Northwest coast, but perhaps because the Patagonians did not have the same degree of taboo towards showing their masks to Westerners, we have good ethnographic records of them. This state of affairs contrasts with Indigenous groups of the Pacific Northwest, for whom records of garments made for similar purposes are sparser, and the form of the masks was more variable than it was for the Patagonian societies. If the goal of this study was to comprehensively include all adornment, then some groups in my sample likely have underreported garment numbers and technounit counts simply because some of their garb was not and was never meant to have been recorded. Perhaps omitting all masks would have been a neater choice, though doing so would have raised questions about the need to omit all ritual or taboo items across the entire sample, and furthermore, doing so may have raised problems about the differences between masks and other types of headgear. The intensity of a given taboo in each culture would likely be difficult to measure, and even if it were measurable, we do not know if ethnographers were able to record taboo items in spite of associated taboos, or through personal influence in defiance of taboos, or through other means entirely.

Certain independent variables were more strongly represented than others: the environmental variables, for example, were fully represented in every society. Others, such as many of the social variables, were often only available for half or somewhat more than half of the societies in the sample. Nonetheless, even in cases in which the dataset was incomplete, the sample sizes were still robust. Furthermore, in some cases, groups of categorical variables were not evenly distributed in the sample. For example, the case of Marital Composition included 10 Monogamous groups, 13 Strongly Polygynous groups, with the remainder being Limited Polygynous. A more even sample may have been desirable, but the overall size of the sample suggests that the results that were produced are valid.

One of the key focuses of this study is on marriage typology. I tried to analyse the effect that degree of polygyny has on wardrobe and garment complexity. One potential problem with such analysis is that marriage typologies may be influenced (recently so) by outside sources. If so, marriage typology may act like the aforementioned ‘recent trade goods’ I attempted to exclude from my dataset due to their likely creation by industrialised societies. Despite the potential problems associated with the notion that marriage typology may be unstable and influenced by recent colonisation, there is reason to think that it is more often an indigenous innovation. Oftentimes, closely related ethnolinguistic groups engaging in some degree of polygyny live near exclusively-monogamous groups. That proximity may suggest some degree of stability of marriage typology. An underlying assumption of my use of marriage typologies is that irrespective of their temporal and geographic stability, they are indigenous innovations, and are not influenced by Christianity or other world religions to any measurable degree. It is possible that some of the monogamous groups in my dataset were influenced by Christian colonists, but the ethnographic record does not, in any case I have found, reference that possibility. If any culture were explicitly regarded as having switched from polygyny to monogamy due to the direct influence of some kind of organised Christian Church, I would have counted that culture as polygynous regardless. Given the diversity and distribution of various small-scale societies’ marital systems across the globe, they are likely, more often than not, indigenous innovations, or at least I am treating them as such.

5.3.1. Test for geographical biases

Small-scale societies are unevenly represented in the ethnographic record with regard to adequate clothing data, with North American groups being better-attested. This state of affairs is particularly true of Arctic societies, for whom there are scant records of Eurasian groups (Siberian ones in particular) and numerous ones for North American ones. A concern with my dataset was that numerically uneven sampling (a larger North American sample relative to the rest of the world) may be disguising an effect of North American groups responding to independent variables differently from other groups due to reasons connected to cultural diffusion or other reasons. I tested this potential limitation in response to that concern.

The relevant data are as follows: NA TNG had a minimum of one, maximum of 49, mean of 26.52, and a standard deviation of 8.16. RoW TNG had a minimum of one, a maximum of 47, a mean of 17, and a standard deviation of 9.52. NA TTS had a minimum of one, a maximum of 221, a mean of 87.22, and a standard deviation of 57.23. RoW TTS had a minimum of one, a maximum of 257, a mean of 43.59, and a standard deviation of 51.93. NA AVE had a minimum of one, a maximum of 6.69, a mean of 3.06, and a standard deviation of 1.23. RoW AVE had a minimum of one, a maximum of 5.47, a mean of 2.12, and a standard deviation of 1.12 (Table 46). Some patterns were immediately clear. First, while each NA/RoW pairing had some similarities, some differences are notable. One is the differences between TNG and TTS means that remain in spite of convergence of minimum values and standard deviations. This suggests a cold-weather bias in the North American sample. However, it was notable that the society with the most complex wardrobe is the Koryaks, a Siberian group.

Table 46: Descriptive statistics for the six main clothing variables when broken down by geographic origin.

Clothing variable	Minimum	Maximum	Mean	Std. Deviation
NA TNG	1	49	26.52	8.16
RoW TNG	1	47	17	9.52
NA TTS	1	221	87.22	57.35
RoW TTS	1	257	43.59	51.93
NA AVE	1	6.69	3.06	1.23
RoW AVE	1	5.47	2.12	1.12

To control for the possibility that the above factors are a result of geographically-biased sampling, tests were re-run for groups in North America (including Greenland and as far south as the Isthmus of Panama) versus those elsewhere. It is expected that there will be some difference in the complexity of North American garment richness versus Rest of the World garment richness due to most of the high-latitude cultures—especially the extreme high latitude ones—being from North America, thus relegating groups of the Eurasian Arctic to the whims of small sample size. However, the differences in associations with environmental variables should be more minor than the differences in TNG, TTS, and AVE. If there were a large gulf between NA and RoW groups' wardrobes' associations with environmental variables, then this study is not truly generalisable across all small-scale hunter-gatherers.

Table 47 shows the correlations between NA/RoW clothing variables and the environmental variables. The consistent negative correlations between each clothing variable and the temperature-related variables are notable. With regard to the precipitation-related variables, the directions of the correlations between the NA and RoW variables are the same: positive with Average Relative Humidity and Average Yearly Snowfall and negative with Average Yearly Precipitation. All associations between each clothing variable and Average Annual Temperature, Average Wind Chill, and Peak Wind Chill reached statistical significance. In addition, the correlations between NA AVE and Average Yearly Precipitation along with NA TNG and RoW AVE with Average Yearly Snowfall reached statistical significance. The hypothesis of this section was therefore supported: the associations between the environmental and clothing variables are not due to hunter-gatherers' geographical locations.

*Table 47: Simple linear regression results for North America Total Number of Garments (NA TNG), Rest of the World Total Number of Garments (RoW TNG), North America Total Number of Technounits (NA TTS), Rest of the World Total Number of Technounits (RoW TTS), North America Average Number of Technounits per Garment (NA AVE), and Rest of the World Average Number of Technounits per Garment (RoW AVE), along with the environmental variables. *Relationship is significant (2-tailed).*

	Average Annual Temperature	**Average Wind Chill**	**Peak Wind Chill**	**Average Relative Humidity**	**Average Yearly Precipitation**	**Average Yearly Snowfall**
NA TNG	r^2=-0.486 p=.000*	r^2=-0.280 p=.006*	r^2=-0. 347 p=.002*	r^2=0.088 p=.092	r^2=-0.044 p=.796	r^2=0.135 p=.048*
RoW TNG	r^2=-0.311 p=.002*	r^2=-0.310 p=.002*	r^2=-0. 350 p=.002*	r^2=0.002 p=.341	r^2=-0.030 p=.618	r^2=0.006 p=.364
NA TTS	r^2=-0.730 p=.000*	r^2=-0.705 p=.000*	r^2=-0.110 p=.022*	r^2=0.069 p=.119	r^2=-0.110 p=.067	r^2=0.033 p=.199
RoW TTS	r^2=0.537 p=.000*	r^2=0.607 p=.000*	r^2=0.729 p=.000*	r^2=0.007 p=.285	r^2=-0.018 p=.235	r^2=0.010 p=.273
NA AVE	r^2=-0.727 p=.000*	r^2=-0.739 p=.000*	r^2=-0.673 p=.000*	r^2=0.019 p=.246	r^2=-0.230 p=.012*	r^2=0.008 p=.291
RoW AVE	r^2=0.674 p=.000*	r^2=0.523 p=.000*	r^2=0.091 p=.000*	r^2=0.020 p=.228	r^2=-0.059 p=.117	r^2=0.113 p=.048*

While differences in degree of association between the NA and RoW groups and the environmental variables were present, they are relatively slight. Though both groups' clothing variables are strongly correlated with environmental variables, North American groups' wardrobes and components correlate with environmental variables more strongly. That stronger correlation may indicate that the clothing of North American groups is more strongly influenced by the need to mitigate environmental hazards than is the clothing of non-North American groups.

Different variables correlate more strongly against one or the other geographic groupings: Average Wind Chill is correlated more strongly with the wardrobes of societies in the Rest of the World group, though Average Annual Temperature plays a stronger role in shaping the North American groups' wardrobes. Precipitation, humidity, and snowfall correlate much more strongly with North American societies groups than they do with Rest of the World societies.

There are stark differences between the two groups, most notably in the "wetness" variables. Snowfall can likely be excluded in importance irrespective of the differences between the groups, simply due to the fact that the vast majority of groups exposed to snow in my sample are from North America. The divide between the two groups' correlations with humidity and precipitation are likely, again, a reflection of sampling more warm-weather groups outside of North America. The differences between the temperature variables associated with either group are slighter, and are likely also due to differences in geographic sampling. While the North American Arctic groups are represented by four truly Arctic societies (the Polar Inuit, Tareumiut, Copper Inuit, and Deg Xit'an), they are represented by an additional several (such as the Kaska) whose environments dictate that they have clothing meant to deal with near-Arctic temperatures on a regular basis. The Rest of the World group includes groups such as the Koryaks and Nivkh, whose environments and wardrobes bear strong similarities to the North American groups. However, the Rest of the World group also includes the Nenets, whose clothing is a notable outlier in terms of its simplicity given their environment. Furthermore, that group includes Tasmanians and several Patagonian groups whose clothing is significantly simpler than one would expect given the ambient temperature those groups experience.

One result worth highlighting is that Peak Wind Chill has a much stronger relationship with RoW technounit variables than it does with North American technounit variables, and this is particularly true of RoW Average Technounits per Garment (90.1% variance explained, in contrast to 67.3% for North American Average Technounits per Garment). Sample size may be a concern here. The RoW sample has far fewer groups living close to the North Pole, and fewer higher-latitude groups more generally. Thus, the few RoW high-latitude groups' garments may be skewing the dataset.

The main concern this analysis was meant to address was the possibility that one of the two groupings had no correlation with several or all of the variables. Despite some differences in the degrees of correlation due to some notable outliers in the RoW grouping, it is clear that groups around the world have clothes whose designs are driven by many of the same environmental hazards. Nonetheless, the reasons for the presence of outliers in the sample, perhaps, begs further investigation.

5.4. FUTURE DIRECTIONS

The gulf between the importance of the temperature variables and the importance of the precipitation-related variables suggest that the latter play no role in shaping cross-cultural clothing complexity, and can thus be left out of future analyses of this types.

One prediction made possible by the literature on the use of fur ruffs on parkas (and their being primarily an anti-frostbite tool) is that areas with the highest wind speeds should yield most complex gloves and ruffs. Testing that prediction would be difficult because the differences in technounit number between various cultures' garments and fur trim/ruffs across cultures are slight. Furthermore, Average Annual Temperature's role in shaping clothing design may be large enough to make testing the differences in glove and ruff design pointless. Given the role that the use of fur ruffs may have played in aiding the survival of *H. sapiens* over Neanderthals in Upper Pleistocene Eurasia, such analyses are desirable. It may be that Peak Wind Chill and Average Wind Chill are variables that are particularly predictive of the use of fur trim on garments rather than Average Annual Temperature on its own.

This study makes a distinction between products and processes, with the former referring to the end results of manufacturing and the latter referring to the act of manufacturing itself. This study concentrated only on end-products. However, our understanding of the exact relationship of products and the process of making clothing is limited, especially with regard to time-investment and the role of the expertise of manufacturers. If Oswalt's method is misunderstood as being a proxy for manufacturing processes, it could be surmised that a low-technounit garment (for example a blanket made of dozens of rabbit skins), is simple in the broadest sense of the term. The label of 'simple' does not take into account the time needed to hunt the rabbits, prepare their skins and make the garment itself, which could be considerably longer than using plant fibers to make a belt composed of half a dozen technounits. If an analysis took into account manufacturing and preparation time for different garments, more conclusions could be drawn about the nature of human time-investment in certain items, especially those related to prestige, ceremonies, and other processes viewed by most societies as extremely important, but particularly deficient in terms of ethnographic records. A study could be designed that had tailors and non-tailors record their time spent making specific garments and measuring those data against those garments' complexity. Then, the relationship between time spent (and perhaps effort) and garment complexity could be assessed.

This analysis could be redone with the goal of integrating the dichotomy of 'delayed-return' and 'immediate-return' hunter-gatherers in mind. The former are more inclined toward complex food storage, and the latter engage in strategies geared toward immediate sustenance (Layton 2005; Martin and Shirk 2008). It would be expected that the former have more complex material culture and more complex clothing and rich wardrobes particularly. However, it is unknown whether a trend toward sedentism would sharply reduce degrees of association between environmental variables and clothing variables. Therefore, any study examining delayed and immediate-return hunter-gatherers also ought to include farming cultures. Intuitively, farming cultures ought to be more insulated from climatic variables than hunter-gatherers, and if true, their clothing designs ought to be dictated more strongly by non-environmental factors. Furthermore, farmers should be more beholden to altitude being a factor shaping their clothing than are hunter-gatherers due to the former's existence at a variety of elevations. I would expect the clothing of farmers to be less complex on average with a much smaller range of complexity, and a different distribution of importance for environmental variables, with humidity and precipitation playing larger roles in shaping the design of farmers' clothes. An analysis of farmer clothing could allow for the use of additional environmental variables such as Heat Index (a value derived from Average Annual Temperature and Average Relative Humidity), and Average Winter Temperature, which would be useful in determining the relative influence of seasonality on wardrobe design.

The social variables pertinent to this study are likely more fruitful for future study than are the environmental ones—analyses of the former included some unexpected results. Given the increased competition between males in polygynous societies, one future avenue of study is to investigate the link between the human tendency to decorative and

Ingroup Violence, Outgroup Violence, and Marital Composition. Furthermore, the nature of competition itself, with regard to competition both leading to and mitigating violence could use more study. A valid research question regarding male-male competition expressed through decorative clothing is does using decoration on clothing to compete for mates act as an attenuating or contributing factor to male-male violence in polygynous societies? Marital Composition's influence on clothing design is enough that it ought to be tested against other independent variables used in this analysis, such as movement across the landscape.

A more tangential way of supporting or refuting the conclusions indicated by this study is to test the integrity of the ethnographic record itself by looking at clothing design more deeply. Aspects of this report may need to be retested by looking at museum specimens of garments to see both if the results reported here hold true for real-world examples of clothing. My viewing of museum collections suggests that the ethnographic record understates garment complexity, but it likely does so in a consistent manner. Nonetheless, the testing of museum collections with Oswalt's method can both inform on the integrity of the ethnographic record itself and shed light on cross-cultural variations in garment complexity.

Another means of understanding human interactions with their environments as mediated by clothing is to examine clothing's potential explanatory power as it relates to Niche Construction Theory (NCT). NCT suggests that animals modify their own and each other's evolutionary niches via several means including changing landscapes, the use of chemical and biological signals, and modifying nutrient cycling in plants (Laland et al. 2016). Eventually, such changes in the environment may create a feedback loop in which an organism's genes and therefore perhaps their evolutionary trajectory is changed due to theirs or others' modifications of various environments. Clothing could be regarded as an environment unto itself. It certainly creates a microclimate within it that surrounds the wearer. As previously discussed, the link between humans' evolved nakedness (i.e., our apparent hairlessness) seems uncoupled from clothing use. The evidence for that conclusion is reasonable, and touches on various fields from genetics to biology and to archaeology. However, clothing offers a unique laboratory with which that conclusion can truly be tested. As mentioned, groups living closer to the equator tend to be hairier than ones living closer to the poles. If there is a genetically-mediated feedback loop between clothing and apparent hairlessness, one would expect that degree of hairlessness (and its genetic antecedents) may be less prominent than expected in cultures with long-term and habitual use of complex garments.

Chapter 6. CONCLUSION

The balance of the data suggests that human clothing is a complex material culture tradition used—most obviously—to protect wearers from environmental hazards such as the cold, but also to aid and mediate human social interactions via the visual signalling of value primarily related to martial prowess and fertility. Environmental variables such as Average Annual Temperature, Average Wind Chill, and Peak Wind Chill have such strong, consistent relationships with both wardrobe richness and garment complexity that they obviously strongly influence and constrain clothing design across small-scale hunter-gatherers. Many economic, social, and population factors play smaller or no roles in shaping cross-cultural clothing variation. For example, subsistence activities, sexual dimorphism, and population size may influence cross-cultural clothing complexity in some instances, but if they do, their influence is likely quite weak. There are some exceptions to the pattern that non-environmental variables are only weakly associated with clothing variables. Marital Composition seems to be important: polygynous groups have a strong male-bias in their decorative clothing. Similarly, more warlike societies employ more complex garments and richer wardrobes, and that is particularly true of decorative garments and components. Both of these observations beg further explanation.

With regard to the original research question, which variables most strongly influence cross-cultural variations in clothing complexity?, and the Environmental Hypothesis, Average Annual Temperature correlates so strongly with clothing complexity and wardrobe size that it is the main environmental driver of cross-cultural clothing variation. Wind chill, both as a yearly average (Average Wind Chill) and as an average over the coldest months (Peak Wind Chill), is associated with clothing complexity and wardrobe size slightly more weakly than temperature does, despite temperature being a large component of wind chill equations. Nonetheless, wind chill metrics, particularly Peak Wind Chill, are oftentimes the strongest predictors of clothing complexity. Wind chill measures, therefore, are solid predictors of clothing complexity, but their being irrelevant to the majority of the sample (warmer-weather groups) means that Average Wind Chill and Peak Wind Chill will always be incomplete predictors of clothing complexity on a worldwide scale. Average Annual Temperature, on the other hand, is superior in most cases to Average Wind Chill and Peak Wind Chill both in terms of its geographical coverage and in terms of the strength of its correlations with clothing variables. Layering clothing for protection from the elements becomes important in two stages of nLatitude: between 30° and 40° and then again above 60°, with little increase in importance between 40° and 60°. The specific reasons for layering's non-linear increase in importance across the latitudinal scale is unclear, and future research is needed to shed light on that area. Precipitation-related variables such as Average Relative Humidity% and Average Yearly Precipitation play no role in shaping clothing variation, both on an absolute basis and relative to temperature-related ones.

The Economic Hypothesis generally fared poorly in testing, although it is notable that societies relying more on gathering tend to have less rich wardrobes and less complex clothing. The tendency toward fishing likely increases TNG, but seems only to be a factor for northerly groups that need specialised, waterproofed garments for fishing. More mobile groups tend to have higher TNG, TTS, and AVE, while more sedentary groups specifically have more Decorative TNG, TTS, and AVE. Groups employing more complex Food Storage strategies tend to have more Non-Decorative TNG, TTS, and AVE.

In terms of the results of testing the Social Hypothesis, members of polygynous societies are more flamboyant dressers on average, and this is particularly true for men in those societies. Notably, Strongly Polygynous societies, which are the ones with the strongest male-bias in decorative (and non-decorative) clothing, underscoring clothing's role as visual symbol of male-male competition. More warlike societies tend to use more decorations as well, suggesting strong pressures on polygynous and warlike societies to use visual media to enforce boundaries and engage in dominance behaviour. However, the fact that a lack of ingroup violence (likely largely domestic in nature) correlates strongly with a male-bias in decorative clothing may suggest that violence is mediated via an energy budget that links violence committed against outsiders and insiders alike. An alternative is that the link between an absence of Ingroup Violence and a greater male-skew in decorative clothing and also relatively more investment in decorative clothing may suggest that ingroup violence is not tied to male-male competition in the same way that war and other forms of outgroup violence are.

With regard to the Population Hypothesis, societies with larger populations tend to have more complex decorative clothing and components, and societies with lower population densities tend to have more complex non-decorative clothing, but the degree of correlation between density and complexity is middling. The link between density and clothing complexity is difficult to separate from the effects of temperature and wind chill, though the significant influence of population size on decoration is more mysterious. It may be that larger population sizes in hunter-gatherer groups encourage a specific type of material culture complexity unrelated directly to subsistence or immediate survival and protection from the elements.

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Appendix. Supplemental Tables

Table A.1.: List of the names of each of the hunter-gatherer groups in the sample, along with alternate names and/or names used when compositing data. The "Alternate ethnographic name(s)" column contains ethnonyms or exonyms that the groups in the "Name" column are sometimes referred to by in the ethnographic record. The "Proxy" column contains the names of groups in the ethnographic record that were used to fill gaps in the data pertaining the corresponding societies in the "Name" column (see main text).

Name	Alternate ethnographic name(s)	Proxy
Mbuti		
Hadza	Kindiga	
Auin	!Kung; San	
Ainu	Ainos	
Andamans		
Vedda		
Semang		
Koryaks		Chukchee
Nenets	Nganasan; Samoyed	
Polar Inuit	Inuguhit	
Copper Inuit		
Ingalik	Deg Xit'an	
Kaska		
Delaware	Lenape	
Swampy Cree	Attawapiskat; Western Woods Cree	
Klamath	Modoc	
Pomo		
Comanche		
Pawnee		
Tiwi		
Manus		
Aranda	Arunta	
Maori		
Siriono		
Barama River Carib		
Xokleng	Aweikoma; Kaingang	
Ona	Selk'nam	
Yahgan		
Tehuelche		
Miskito	Sumu	
Tlingit		
Tareumiut		
Haida		
Island Carib		
Eastern Tasmanians		
Seri		
Tjapwurrong	Djab wurrung	
Yankunytjatjara	Jankundjara	
Pericúes		Guaicura
Nivkh	Gilyak	
Chenchu		
Wappo	Yuki	
Yurok		
Tubatulabal		
Mi'kmaq		
Botocudo	Aimoré	
Gros Ventre		
Northern Paiute	Wadatkuht	
Dorobo	Okiek	Nandi
Crow		

Table A.2.: Whole wardrobe dataset, including names of each of the 50 hunter-gatherer groups in the sample along with their clothing variable values. TNG = Total Number of Garments. TTS = Total Number of Technounits. AVE = Average Number of Technounits per Garment.

Name	TNG	TTS	AVE	MNL	References
Mbuti	18	22	1.22	4	Turnbull 1962, 1965
Hadza	15	26	1.73	4	Cooper 1949; Marlowe 2010
Auin	25	49	1.96	5	Kaufmann 1908; Lebzelter and Neuse 1934; Lee 1979
Ainu	22	65	2.95	8	Batchelor 1927; Hitchcock 1888; Munro et al. 1996; Ohnuki-Tierny 1984
Andamans	12	17	1.42	3	Man 1932; Mann 1979; Temple 1903
Vedda	11	17	1.55	4	Seligman et al. 1911
Semang	20	36	1.8	4	Schebesta 1962
Koryaks	47	227	5.47	15	Antopova et al. 1964; Jochelson 1908
Nenets	24	106	4.42	13	Islavin 1847; Lehtisalo 1924; Prokof'eva 1964
Polar Inuit	38	213	5.61	13	Holtved 1967
Copper Inuit	34	160	4.71	15	Jenness 1946
Ingalik	49	201	4.1	16	Osgood 1970
Kaska	28	103	3.68	8	Honigmann 1954; Honigmann and Bennett 1949, Teit and Helm 1956
Delaware	25	60	2.4	7	Goddard 1978; Harrington 1921; Herman 1950
Swampy Cree	28	67	2.39	11	Mason 1967; Smith 1981
Klamath	30	75	2.5	9	Barrett 1910; Gatschet 1890; Ray 1963; Spier 1930; Stern 1965
Pomo	28	67	2.39	7	Barrett 1952; Loeb 1926
Comanche	26	78	3	8	Kavanagh 2001; Wallace and Hoebel 1952
Pawnee	24	65	2.71	8	Blaine 1990; Grinnell 1961; Hyde 1974; Murie and Parks 1989; Weltfish 1965
Tiwi	3	4	1.33	2	Goodale 1971; Hart and Pilling 1960
Manus	23	41	1.78	5	Mead 1930
Aranda	13	28	2.15	2	Basedow 1925; Schulze and Tepper 1891; Spencer and Gillen 1927
Maori	20	42	2.05	5	Best 1924; Hiroa 1949
Siriono	1	1	1	1	Holmberg 1959
Barama River Carib	15	31	2.07	2	Gillin 1936
Xokleng	3	5	1.67	4	Henry et al. 1941
Ona	16	39	2.44	6	Cooper 1946a; Gusinde 1931; Lothrop 1928
Yahgan	15	33	2.2	5	Cooper 1946b; Gusinde 1937; Lothrop 1928
Tehuelche	28	63	2.25	4	Cooper 1946; Lothrop 1928; Musters 1873
Miskito	17	34	2	4	Conzemius 1932
Tlingit	39	112	2.87	8	Emmons and de Laguna 1991; de Laguna 1972; Oberg 1980
Tareumiut	33	221	6.7	14	Murdoch 1892; Ray 1885
Haida	25	72	2.88	10	Blackman 1990; Murdock 1934; Swanton 1905
Island Carib	22	38	1.73	3	Ober 1895; Rouse 1948
Eastern Tasmanians	8	11	1.38	2	Baudin 1974; Roth 1899
Seri	11	20	1.82	4	McGee and Hewitt 1898
Tjapwurrong	13	23	1.77	3	Beveridge 1883; Dawson 1881
Yankunytjatjara	9	9	1	1	Lindsay 1893
Pericúes	11	19	1.73	2	Laylander 2000
Nivkh	27	134	4.96	13	Black 1973; Shrenk 1881
Chenchu	22	35	1.59	3	von Furer-Haimendorf 1943
Wappo	17	36	2.12	5	Foster 1944; Miller 1979
Yurok	21	45	2.14	5	Heizer et al. 1952; Kroeber 1925
Tubatulabal	21	52	2.48	8	Voegelin 1938
Mi'kmaq	24	65	2.71	8	Prins 1996; Wallis and Wallis 1953, 1955
Botocudo	13	18	1.38	1	Keane 1883; Metraux 1946
Gros Ventre	25	92	3.68	9	Flannery 1953; Fowler and Flannery 2001; Kroeber 1908
Northern Paiute	23	63	2.74	8	Fowler and Liljeblad 1986; Kelly 1934; Riddell 1960
Dorobo	25	45	1.8	3	Huntingford 1953
Crow	22	68	3.09	7	Denig and Ewers 1961; Lowie 1922, 1924, 1935; Voget 2001

Table A.3.: Male vs. female wardrobe dataset, including names of each of the 50 hunter-gatherer groups in the sample along with either sex's TNG, TTS, and AVE values. MTNG = Male Total Number of Garments. FTNG = Female Total Number of Garments. MTTS = Male Total Number of Technounits. FTTS = Female Total Number of Technounits. MAVE = Male Average Number of Technounits per Garment. FAVE = Female Average Number of Technounits per Garment.

Name	MTNG	FTNG	MTTS	FTTS	MAVE	FAVE	References
Mbuti	6	4	6	7	1	1.75	Turnbull 1962, 1965
Hadza	3	6	3	10	1	1.67	Cooper 1949; Marlowe 2010
Auin	9	8	15	21	1.67	2.63	Kaufmann 1908; Lebzelter and Neuse 1934; Lee 1979
Ainu	1	8	1	18	1	2.25	Batchelor 1927; Hitchcock 1888; Munro et al. 1996; Ohnuki-Tierny 1984
Andamans	2	3	3	4	1.5	1.33	Man 1932; Mann 1979; Temple 1903
Vedda	3	3	6	5	2	1.67	Seligman et al. 1911
Semang	6	7	12	13	2	1.86	Schebesta 1962
Koryaks	15	11	73	69	4.87	6.27	Antopova et al. 1964; Jochelson 1908
Nenets	10	4	58	21	5.8	5.25	Islavin 1847; Lehtisalo 1924; Prokof'eva 1964
Polar Inuit	17	10	104	70	6.12	7	Holtved 1967
Copper Inuit	17	8	81	47	4.76	5.88	Jenness 1946
Ingalik	15	14	64	59	4.27	4.21	Osgood 1970
Kaska	6	6	24	26	4	4.33	Honigmann 1954; Honigmann and Bennett 1949, Teit and Helm 1956
Delaware	7	1	10	1	1.43	1	Goddard 1978; Harrington 1921; Herman 1950
Swampy Cree	11	3	35	14	3.18	4.67	Mason 1967; Smith 1981
Klamath	6	6	14	14	2.33	2.33	Barrett 1910; Gatschet 1890; Ray 1963; Spier 1930; Stern 1965
Pomo	11	4	24	10	2.18	2.5	Barrett 1952; Loeb 1926
Comanche	14	4	36	17	2.57	4.25	Kavanagh 2001; Wallace and Hoebel 1952
Pawnee	14	4	30	16	2.14	4	Blaine 1990; Grinnell 1961; Hyde 1974; Murie and Parks 1989; Weltfish 19
Tiwi	2	1	3	1	1.5	1	Goodale 1971; Hart and Pilling 1960
Manus	7	12	11	25	1.57	2.08	Mead 1930
Aranda	6	5	14	10	2.33	2	Basedow 1925; Schulze and Tepper 1891; Spencer and Gillen 1927
Maori	8	2	15	3	1.88	1.5	Best 1924; Hiroa 1949
Siriono	1	0	1	0	1	0	Holmberg 1959
Barama River Carib	7	5	16	9	2.29	1.8	Gillin 1936
Xokleng	2	1	3	2	1.5	2	Henry et al. 1941
Ona	7	3	17	8	2.43	2.67	Cooper 1946a; Gusinde 1931; Lothrop 1928
Yahgan	3	0	11	0	3.67	0	Cooper 1946b; Gusinde 1937; Lothrop 1928
Tehuelche	11	9	25	21	2.27	2.33	Cooper 1946; Lothrop 1928; Musters 1873
Miskito	11	1	21	1	1.91	1	Conzemius 1932
Tlingit	12	5	36	15	3	3	Emmons and de Laguna 1991; de Laguna 1972; Oberg 1980
Tareumiut	18	8	128	62	7.11	7.75	Murdoch 1892; Ray 1885
Haida	2	3	5	5	2.5	1.67	Blackman 1990; Murdock 1934; Swanton 1905
Island Carib	11	3	20	7	1.82	2.33	Ober 1895; Rouse 1948
Eastern Tasmanians	3	2	6	2	2	1	Baudin 1974; Roth 1899
Seri	0	0	0	0	0	0	McGee and Hewitt 1898
Tjapwurrong	1	2	1	3	1	1.5	Beveridge 1883; Dawson 1881
Yankunytjatjara	5	0	5	0	1	0	Lindsay 1893
Pericúes	2	6	4	12	2	2	Laylander 2000
Nivkh	7	7	40	32	5.71	4.57	Black 1973; Shrenk 1881
Chenchu	9	8	12	17	1.33	2.13	von Furer-Haimendorf 1943
Wappo	8	3	19	5	2.38	1.67	Foster 1944; Miller 1979
Yurok	12	6	29	11	2.42	1.83	Heizer et al. 1952; Kroeber 1925
Tubatulabal	1	8	7	15	7	1.88	Voegelin 1938
Mi'kmaq	4	8	9	19	2.25	2.38	Prins 1996; Wallis and Wallis 1953, 1955
Botocudo	8	0	12	0	1.5	0	Keane 1883; Metraux 1946
Gros Ventre	8	7	27	23	3.38	3.29	Flannery 1953; Fowler and Flannery 2001; Kroeber 1908
Northern Paiute	4	7	13	23	3.25	3.29	Fowler and Liljeblad 1986; Kelly 1934; Riddell 1960
Dorobo	16	8	30	14	1.88	1.75	Huntingford 1953
Crow	12	3	40	13	3.33	4.33	Denig and Ewers 1961; Lowie 1922, 1924, 1935; Voget 2001

Table A.4.: Decorative vs. Non-Decorative wardrobe dataset, including names of each of the 50 hunter-gatherer groups in the sample along with both decorative and non-decorative TNG, TTS, AVE. DTNG = Decorative Total Number of Garments. NDTNG = Non-Decorative Total Number of Garments. DTTS = Decorative Total Number of Technounits. NDTTS = Non-Decorative Total Number of Technounits. DAVE = Decorative Average Number of Technounits per Garment. NDAVE = Non-Decorative Average Number of Technounits per Garment.

Name	DTNG	NDTNG	DTTS	NDTTS	DAVE	NDAVE	References
Mbuti	15	3	15	7	0.83	0.39	Turnbull 1962, 1965
Hadza	10	5	10	16	0.67	1.07	Cooper 1949; Marlowe 2010
Auin	10	15	14	35	0.56	1.4	Kaufmann 1908; Lebzelter and Neuse 1934; Lee 1979
Ainu	10	12	14	51	0.64	2.32	Batchelor 1927; Hitchcock 1888; Munro et al. 1996; Ohnuki-Tierny 1984
Andamans	7	5	7	10	0.58	0.83	Man 1932; Mann 1979; Temple 1903
Vedda	5	6	5	12	0.45	1.09	Seligman et al. 1911
Semang	13	7	14	22	0.7	1.1	Schebesta 1962
Koryaks	20	27	38	219	0.81	4.66	Antopova et al. 1964; Jochelson 1908
Nenets	8	16	23	83	0.96	3.46	Islavin 1847; Lehtisalo 1924; Prokof'eva 1964
Polar Inuit	3	35	3	210	0.08	5.53	Holtved 1967
Copper Inuit	9	25	23	137	0.68	4.03	Jenness 1946
Ingalik	19	30	35	166	0.71	3.39	Osgood 1970
Kaska	15	13	24	79	0.86	2.82	Honigmann 1954; Honigmann and Bennett 1949, Teit and Helm 1956
Delaware	16	9	26	34	1.04	1.36	Goddard 1978; Harrington 1921; Herman 1950
Swampy Cree	12	10	19	48	0.68	1.71	Mason 1967; Smith 1981
Klamath	17	13	21	54	0.7	1.8	Barrett 1910; Gatschet 1890; Ray 1963; Spier 1930; Stern 1965
Pomo	13	15	21	46	0.75	1.64	Barrett 1952; Loeb 1926
Comanche	12	14	25	53	0.96	2.04	Kavanagh 2001; Wallace and Hoebel 1952
Pawnee	15	9	19	46	0.79	1.92	Blaine 1990; Grinnell 1961; Hyde 1974; Murie and Parks 1989; Weltfish 1965
Tiwi	2	1	2	2	0.67	0.67	Goodale 1971; Hart and Pilling 1960
Manus	18	5	22	19	0.96	0.83	Mead 1930
Aranda	12	2	16	12	1.23	0.92	Basedow 1925; Schulze and Tepper 1891; Spencer and Gillen 1927
Maori	11	9	12	30	0.6	1.5	Best 1924; Hiroa 1949
Siriono	0	1	0	1	0	1	Holmberg 1959
Barama River Carib	11	6	15	16	1	1.07	Gillin 1936
Xokleng	0	3	0	5	0	1.67	Henry et al. 1941
Ona	8	8	11	28	0.69	1.75	Cooper 1946a; Gusinde 1931; Lothrop 1928
Yahgan	10	5	13	20	0.87	1.33	Cooper 1946b; Gusinde 1937; Lothrop 1928
Tehuelche	18	10	24	39	0.86	1.39	Cooper 1946; Lothrop 1928; Musters 1873
Miskito	12	5	17	17	1	1	Conzemius 1932
Tlingit	24	14	39	67	1	1.72	Emmons and de Laguna 1991; de Laguna 1972; Oberg 1980
Tareumiut	23	12	33	188	1	5.7	Murdoch 1892; Ray 1885
Haida	17	8	22	50	0.88	2	Blackman 1990; Murdock 1934; Swanton 1905
Island Carib	20	2	22	15	1	0.68	Ober 1895; Rouse 1948
Eastern Tasmanians	4	4	4	7	0.5	0.88	Baudin 1974; Roth 1899
Seri	7	4	8	12	0.73	1.09	McGee and Hewitt 1898
Tjapwurrong	7	6	9	15	0.69	1.15	Beveridge 1883; Dawson 1881
Yankunytjatjara	5	4	5	4	0.56	0.44	Lindsay 1893
Pericúes	9	2	10	9	0.91	0.82	Laylander 2000
Nivkh	14	13	20	114	0.74	4.22	Black 1973; Shrenk 1881
Chenchu	13	9	16	19	0.73	0.86	von Furer-Haimendorf 1943
Wappo	9	8	11	26	0.65	1.53	Foster 1944; Miller 1979
Yurok	14	7	17	7	0.81	0.33	Heizer et al. 1952; Kroeber 1925
Tubatulabal	7	14	10	42	0.48	2	Voegelin 1938
Mi'kmaq	11	13	20	45	0.83	1.88	Prins 1996; Wallis and Wallis 1953, 1955
Botocudo	7	6	7	11	0.54	0.85	Keane 1883; Metraux 1946
Gros Ventre	15	1	23	69	0.92	2.76	Flannery 1953; Fowler and Flannery 2001; Kroeber 1908
Northern Paiute	6	17	7	56	0.3	2.43	Fowler and Liljeblad 1986; Kelly 1934; Riddell 1960
Dorobo	19	6	20	25	0.8	1	Huntingford 1953
Crow	16	6	22	46	1	2.09	Denig and Ewers 1961; Lowie 1922, 1924, 1935; Voget 2001

References for Appendix

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