ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL

MODELING MOBILITY-BASED INTANGIBLE HERITAGE: REVEALING, SYSTEMATIZING, AND GENERATING THROUGH YÖRÜK SPATIAL PRACTICES

Ph.D. THESIS

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Department of Informatics

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MAY 2026

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ISTANBUL TEKNİK ÜNİVERSİTESİ ★ LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ

MOBİLİTE TEMELLİ SOMUT OLMAYAN KÜLTÜREL MİRASI MODELLEMEK: YÖRÜK MEKÂNSAL PRATİKLERİ ÜZERİNDEN AÇIĞA ÇIKARMA, SİSTEMATİKLEŞTİRME VE YENİDEN ÜRETME

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Uğur Efe UÇAR, Ph.D. student of ITU Graduate School student ID 523212007, successfully defended the thesis/dissertation entitled "MODELING MOBILITY-BASED INTANGIBLE HERITAGE: REVEALING, SYSTEMATIZING, AND GENERATING THROUGH YÖRÜK SPATIAL PRACTICES", which he prepared after fulfilling the requirements specified in the associated legislations, before the jury whose signatures are below.

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Date of Submission : 16 April 2026
Date of Defense : 12 May 2026

To my family,

FOREWORD

Mobility-based cultures are increasingly at risk of being reduced to static representations, stripped of the very dynamics that once sustained them. When cultural practices grounded in movement, adaptation, and relational space are frozen into descriptive accounts alone, they risk becoming little more than markers of what once existed almost like an empty epitaph. This doctoral dissertation emerged from a concern with such forms of loss and from an effort to approach culture not as a vanishing object to be memorialized, but as a living and productive knowledge system capable of informing contemporary design thinking.

The research presented in this dissertation is the outcome of a long and layered intellectual journey shaped by observation, questioning, and sustained engagement with spatial and cultural practices. Throughout this process, the development of ideas was supported not only by academic inquiry, but also by collective effort, shared environments, and enduring forms of encouragement. I would therefore like to express my sincere gratitude to the individuals and institutions who contributed directly and indirectly to this work.

First and foremost, I would like to express my deepest appreciation to my advisor, Assoc. Prof. Dr. Ethem GÜRER, for his guidance, critical insight, and continuous support throughout the doctoral process. His thoughtful and rigorous approach played a decisive role not only in shaping the direction of this research, but also in my development as an academic. I am also sincerely grateful to my jury members, Prof. Dr. Mine ÖZKAR and Prof. Dr. Özgür EDİZ, whose valuable evaluations, questions, and academic rigor significantly contributed to the refinement and maturation of this dissertation. It was a genuine pleasure to engage in discussion with such intellectually generous scholars. I would also like to extend my sincere thanks to Assoc. Prof. Dr. Derya GÜLEÇ ÖZER and Assist. Prof. Dr. Amina REZOUG AYAR for their valuable contributions, insightful feedback, and thoughtful participation in the final dissertation jury, which further enriched this study.

This dissertation was conducted within the academic environment of Istanbul Technical University, shaped by the intersection of teaching, learning, and research. I would like to thank my colleagues and students at the Interior Architecture Department, where I have been actively teaching, for the intellectual exchange, critical discussions, and shared production that continuously enriched this work. At the same time, I would like to express my sincere appreciation to all components of the Architectural Design Computing Programme, within which this dissertation was developed, whose interdisciplinary structure, critical research culture, and balanced integration of theoretical inquiry and computational exploration provided a fertile ground for the conceptual and methodological development of this study.

I would like to express my deepest gratitude to my family for their constant support, patience, and understanding throughout this long and demanding process. Their presence provided a sense of stability and encouragement that made it possible to sustain both the intellectual and emotional dimensions of this journey. A special acknowledgement is owed to Gözde GÖKDEMİR, with whom sharing the same home and the same period of doctoral research made this journey both more demanding and more meaningful. Ironically, while this dissertation investigates mobility-based cultures, much of our own doctoral work was carried out through an intensely immobile practice, with long hours spent side by side, working at fixed desks, negotiating silence, deadlines, and mutual support within the same domestic space. Experiencing this process together transformed what might have been an individual academic endeavor into a deeply shared one.

Finally, I would like to emphasize that this dissertation does not mark an end, but rather a continuation of an ongoing search. The effort to understand space, culture, and design through movement, transformation, and relational thinking remains open-ended. This work is therefore not a conclusion, but a point of departure for further inquiry.

May 2026

Uğur Efe UÇAR
(Interior Architect)

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ABBREVIATIONS

2D	**:** Two-Dimensional
3D	**:** Three-Dimensional
FF	**:** Fitness Functions
GA	**:** Genetic Algorithms
ICOMOS	**:** International Council on Monuments and Sites
LEE	**:** Lisansüstü Eğitim Enstitüsü
RBD	**:** Rule-Based Design
VAK	**:** Vernacular Architectural Knowledge

SYMBOLS

FF01	**:** Fitness Function 1
FF02	**:** Fitness Function 2
FF03	**:** Fitness Function 3
(–)	**:** Cover Modules of the System
(O)	**:** Load-Bearing Elements of the System
(X)	**:** Connectors of the System
≤	**:** Less Than or Equal
$\omega_1, \omega_2, \omega_3$	**:** Coefficients of Algorithm

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MODELING MOBILITY-BASED INTANGIBLE HERITAGE: REVEALING, SYSTEMATIZING, AND GENERATING THROUGH YÖRÜK SPATIAL PRACTICES

SUMMARY

Conventional approaches to cultural heritage studies have predominantly addressed space through permanent structures, fixed settlements, and tangible physical traces, while mobility-based ways of living have often been treated as secondary or difficult-to-represent domains. However, nomadic and semi-nomadic cultures produce distinctive knowledge systems in which space is not conceived as a static object but as a process continuously constructed through time, movement, and relational practices. This doctoral dissertation examines Yörük culture within the framework of mobility-based intangible cultural heritage and investigates how its spatial practices can be revealed, systematized, and re-generated within contemporary design contexts.

The study approaches culture not merely as a body of heritage to be preserved, but as a productive knowledge system operating in interaction with design and computational thinking. In this respect, mobility is positioned as a central conceptual axis connecting culture, design, and computational thinking. The primary aim of the dissertation is to make explicit the tacit knowledge embedded in Yörük spatial practices, to systematize this knowledge within a relational and rule-based structure, and ultimately to transform it into a re-generative design knowledge through computational design approaches.

The dissertation is structured into five interrelated chapters, forming a comprehensive research process organized around the stages of revealing, systematizing, and generating knowledge. The *first chapter* establishes the theoretical, conceptual, and methodological framework of the study. It discusses the relationships between culture and computational thinking, culture and design, and design and computational thinking, and defines mobility as both a conceptual and methodological connector across these domains. This chapter also presents the problem statement, research objectives, and hypotheses, and outlines the overall structure of the thesis, explaining how mobility-based spatial knowledge is addressed and transformed throughout the study.

The *second chapter* examines Yörük culture through a phenomenological approach, focusing on the spatial and temporal organization of nomadic life. Drawing on the literatures of nomadism, utopian thinking, and phenomenology, this chapter argues that Yörük spatial practices offer an alternative spatial worldview to sedentary architectural paradigms. Space is understood not in terms of permanence or fixed form, but through cyclicality, temporality, and lived experience. Practices related to dwelling, settlement, everyday life, and movement are analyzed to demonstrate that Yörük spatial knowledge cannot be reduced to physical structures alone, but is constituted through dynamic, experiential, and relational processes. In this context, Yörük spatial practices are positioned not merely as historical or ethnographic data, but as a productive knowledge domain for design thinking.

The *third chapter* focuses on the systematization of the spatial knowledge derived from Yörük practices, building upon the conceptual and phenomenological framework established in the previous chapter. Field studies, visual documentation, written sources, and cultural narratives are re-processed to analyze spatial organization, structural relationships, patterns of use, and movement. The objective of this chapter is to transform intuitively transmitted and tacit spatial knowledge into an explicit and transferable structure. Through identifying key spatial components and the relationships among them, a systematic framework is developed that enables cultural knowledge to be modeled as a rule-based and relational system. This chapter constitutes a critical methodological threshold by moving beyond descriptive representation toward the formalization of cultural knowledge as a design-relevant system.

The *fourth chapter* investigates how the systematized spatial knowledge can be transformed into a productive mechanism within computational design processes. Rule-based approaches, generative design logic, and computational models are employed to generate alternative spatial configurations derived from Yörük spatial practices. Rather than treating cultural heritage as an object of representation or preservation alone, this chapter explores its reinterpretation and multiplication through design. The computationally generated spatial outputs demonstrate how mobility-based intangible cultural heritage can be translated into contemporary design environments and adapted to different contexts. In this way, cultural knowledge is repositioned as an active design input rather than a passive reference.

The *fifth and final chapter* provides a comprehensive evaluation of the findings and discusses the theoretical, methodological, and design-oriented contributions of the dissertation. It addresses the potentials and limitations of approaching mobility-based cultural knowledge as a generative design resource and outlines directions for future research. The dissertation concludes by emphasizing that cultural heritage should not be understood as a static narrative of the past, but as a dynamic knowledge domain shaped through movement, transformation, and re-generation.

In conclusion, this doctoral dissertation presents a comprehensive approach to mobility-based intangible cultural heritage by revealing, systematizing, and re-generating Yörük spatial practices through computational design. By re-conceptualizing the relationships between culture, design, and computational thinking, the study establishes a strong theoretical and methodological foundation for considering cultural knowledge as a productive input in architectural and design research.

MOBİLİTE TEMELLİ SOMUT OLMAYAN KÜLTÜREL MİRASI MODELLEMEK: YÖRÜK MEKÂNSAL PRATİKLERİ ÜZERİNDEN AÇIĞA ÇIKARMA, SİSTEMATİKLEŞTİRME VE YENİDEN ÜRETME

ÖZET

Kültürel miras çalışmalarında hâkim olan yerleşik yaklaşımlar, mekânı çoğunlukla kalıcı yapılar, sabit yerleşimler ve fiziksel izler üzerinden ele alırken; hareket, geçicilik ve mobiliteye dayalı yaşam biçimleri çoğu zaman ikincil ya da temsil edilmesi güç alanlar olarak değerlendirilmiştir. Oysa göçebe ve yarı-göçebe kültürler, mekânı durağan bir nesne değil; zaman, hareket ve ilişkiler ağı içerisinde sürekli yeniden kurulan bir süreç olarak ele alan özgün bilgi sistemleri üretmektedir. Bu bağlamda çalışma, yalnızca mekânsal temsillerin değil, hangi bilgi biçimlerinin görünür, meşru ve tasarım açısından üretken kabul edildiğinin de sorgulanması gerektiğini savunmaktadır. Mobilite temelli bilgi sistemlerinin tarihsel olarak durağan, yerleşik ve standartlaşmış tasarım paradigmaları karşısında ikincil konumda kalması, bu araştırmanın kuramsal çıkış noktalarından birini oluşturmaktadır. Bu doktora tezi, Yörük kültürünü mobilite temelli somut olmayan kültürel miras bağlamında inceleyerek, bu kültüre özgü mekânsal pratiklerin nasıl açığa çıkarılabileceğini, nasıl sistematikleştirilebileceğini ve çağdaş tasarım ortamlarında nasıl yeniden üretilebilir hale getirilebileceğini araştırmaktadır.

Çalışma, kültürü yalnızca korunması gereken bir miras alanı olarak değil; tasarım ve hesaplamalı düşünme ile etkileşim içerisinde işleyen üretken bir bilgi sistemi olarak ele almaktadır. Bu doğrultuda mobilite kavramı, kültür, tasarım ve hesaplamalı düşünme arasındaki ilişkileri birbirine bağlayan temel bir kavramsal eksen olarak tanımlanmıştır. Tezin temel amacı, Yörük mekânsal pratiklerinde gömülü olan örtük bilginin (tacit knowledge) görünür kılınması, bu bilginin ilişkisel ve kural tabanlı bir yapı içinde sistematikleştirilmesi ve son aşamada hesaplamalı tasarım yaklaşımları aracılığıyla yeniden üretilebilir bir tasarım bilgisine dönüştürülmesidir. Bu dönüşüm, kültürel deneyimin tüm karmaşıklığını eksiksiz biçimde hesaplamalı sistemlere aktarmayı hedeflememekte; bunun yerine, tasarım açısından üretken olan ilişkisel ilkelerin seçici ve yorumlayıcı bir soyutlama süreciyle görünür hale getirilmesini amaçlamaktadır.

Tez, birbirini izleyen ve birbirine eklemlenen beş ana bölümden oluşmaktadır. Bu bölümler, “açığa çıkarma”, “sistematikleştirme” ve “yeniden üretme” aşamalarını kapsayan bütüncül bir araştırma süreci olarak kurgulanmıştır. Birinci bölümde çalışmanın kuramsal, kavramsal ve metodolojik çerçevesi oluşturulmuştur. Bu kapsamda kültür–hesaplamalı düşünme, kültür–tasarım ve tasarım–hesaplamalı düşünme ilişkileri ayrı ayrı ele alınmış; bu alanların kesişiminde mobilite kavramı hem kuramsal hem de metodolojik bir bağlayıcı olarak tanımlanmıştır. Bu bölümde ayrıca çalışmanın problem tanımı, amacı ve hipotezleri ortaya konmuş; Yörük mekânsal bilgisinin hangi adımlar üzerinden ele alınacağı ve bu bilginin nasıl üretken bir tasarım girdisine dönüştürüleceği ayrıntılı biçimde açıklanmıştır.

İkinci bölümde, Yörük kültürü fenomenolojik bir yaklaşımla ele alınarak, göçebe yaşam biçiminin mekânsal ve zamansal örgütlenişi derinlemesine incelenmiştir. Bu bölümde göçebelik, ütopya ve fenomenoloji literatürleri birlikte değerlendirilmiş; Yörük yaşam pratiklerinin yerleşik mimarlık anlayışına alternatif bir mekânsal dünya sunduğu tartışılmıştır. Mekânın süreklilikten ziyade döngüsellik, kalıcılıktan ziyade geçicilik ve nesnel formdan ziyade deneyim üzerinden kurulması, Yörük kültürüne özgü mekânsal bilginin temel bileşenleri olarak ele alınmıştır. Ayrıca barınma, yerleşme, gündelik yaşam ve hareket pratiklerinin mekânla kurduğu ilişkiler analiz edilerek, Yörük mekânsal bilgisinin yalnızca fiziksel yapılara indirgenemeyecek, zamansal ve ilişkisel bir yapı sergilediği ortaya konmuştur. Bu bölüm, Yörük mekânsal pratiklerini tarihsel bir anlatının ötesinde, tasarım düşüncesi açısından üretken bir bilgi alanı olarak konumlandırmaktadır.

Üçüncü bölümde, ikinci bölümde ortaya konan fenomenolojik ve kavramsal çerçeve temel alınarak, Yörük mekânsal pratiklerinden türeyen bilginin sistematikleştirilmesi hedeflenmiştir. Bu aşamada saha çalışmaları, görsel belgeler, yazılı kaynaklar ve kültürel anlatılar yeniden işlenmiş; mekânsal organizasyon, yapısal ilişkiler, kullanım senaryoları ve hareket örüntüleri ilişkisel bir çerçevede analiz edilmiştir. Elde edilen veriler, örtük ve sezgisel biçimde aktarılan mekânsal bilginin açık hale getirilmesini amaçlayan analitik bir süzgeçten geçirilmiştir. Bu bölümde, Yörük mekânsal bilgisinin bileşenleri tanımlanmış, bu bileşenler arasındaki ilişkiler ortaya konmuş ve bilginin kurallı bir yapıya dönüştürülebileceği bir sistematik geliştirilmiştir. Böylece kültürel bilginin betimleyici bir anlatı olmaktan çıkarılarak, aktarılabilir ve yeniden kullanılabilir bir bilgi sistemine dönüştürülmesi amaçlanmıştır.

Dördüncü bölümde, sistematikleştirilen bu mekânsal bilginin hesaplamalı tasarım bağlamında nasıl üretken bir tasarım mekanizmasına dönüştürülebileceği araştırılmıştır. Bu kapsamda kural tabanlı yaklaşımlar, üretici tasarım mantıkları ve hesaplamalı modeller kullanılarak, Yörük mekânsal pratiklerinden türeyen ilişkiler üzerinden alternatif mekânsal konfigürasyonlar üretilmiştir. Bu bölüm, kültürel mirasın yalnızca temsil edilmesi ya da korunması yerine, tasarım yoluyla yeniden yorumlanması ve çoğaltılması fikrini tartışmaktadır. Hesaplamalı süreçler aracılığıyla üretilen mekânsal çıktılar, Yörük mekânsal bilgisinin çağdaş tasarım ortamlarında nasıl dönüştürülebileceğini ve farklı bağlamlara uyarlanabileceğini göstermektedir. Böylece mobilite temelli somut olmayan kültürel miras, pasif bir referans olmaktan çıkarılarak aktif bir tasarım girdisi haline getirilmiştir.

Beşinci ve son bölümde, elde edilen tüm bulgular bütüncül bir perspektifle değerlendirilmiş ve çalışmanın kuramsal, metodolojik ve tasarımsal katkıları tartışılmıştır. Bu bölümde mobilite temelli kültürel bilginin mimarlık ve tasarım araştırmaları için sunduğu olanaklar, bu yaklaşımın sınırlılıkları ve gelecekteki araştırmalara açtığı potansiyel yönelimler ele alınmıştır. Tez, kültürel mirasın durağan bir geçmiş anlatısı değil; hareket, dönüşüm ve yeniden üretim üzerinden ele alınması gereken dinamik bir bilgi alanı olduğunu vurgulayarak sonuçlanmaktadır.

Sonuç olarak bu doktora tezi, Yörük mekânsal pratiklerini mobilite temelli somut olmayan kültürel miras bağlamında ele alarak, bu mirasın açığa çıkarılması, sistematikleştirilmesi ve hesaplamalı tasarım aracılığıyla yeniden üretilmesine yönelik kapsamlı bir yaklaşım sunmaktadır. Çalışma, kültür, tasarım ve hesaplamalı düşünme arasındaki ilişkileri yeniden tanımlayarak, mimarlık ve tasarım disiplinlerinde kültürel bilginin üretken bir tasarım girdisi olarak ele alınmasına yönelik güçlü bir kuramsal ve metodolojik zemin oluşturmayı amaçlamaktadır. Bu yönüyle tez, tasarım bilgisinin

tekil ve evrensel bir çerçevede tanımlanmasına karşı, farklı yaşam biçimlerinden türeyen çoğul tasarım zekâlarının çağdaş tasarım düşüncesine katkı sunabileceğini ortaya koymaktadır.

1. INTRODUCTION

For centuries, the Yörüks, one of Anatolia's prominent mobility-based pastoral communities, organized life through seasonal movement between geographically distinct environments. Moving between warmer lowlands during winter and cooler highlands during summer, this cyclical pattern of migration emerged as a direct response to environmental conditions, the needs of livestock, and the ecological rhythms of the landscape. Within this mode of life, mobility was not simply a means of relocation, but a fundamental framework through which relationships between humans, animals, objects, space, and the environment were continuously negotiated.

Such a mobility-based existence required the development of highly adaptive spatial and material practices. Temporary settlements were established in response to topography, climate, access to natural resources, and social organization. Objects were expected to be portable, multifunctional, and responsive to repeated assembly, disassembly, and transportation. Spatial organization was shaped not through permanence, but through temporality, proximity, environmental awareness, and collective practices. In this sense, Yörük life produced a rich body of tacit design knowledge embedded within everyday practices of movement, adaptation, and habitation.

Historically rooted in Anatolia's cultural landscape, Yörük communities have often been examined through ethnographic, anthropological, and socio-historical perspectives. However, the design intelligence embedded within their mobility-based lifeways remains comparatively underexplored. At the same time, processes of modernization, sedentarization, urbanization, economic transformation, government policies, and cultural assimilation have progressively weakened the continuity of these practices. As a result, forms of experiential and culturally embedded knowledge developed through long-term environmental adaptation face increasing risk of disappearance.

This doctoral thesis investigates how mobility-based, culturally embedded design knowledge, which often remains tacit, experiential, and context-specific, can be revealed, systematized, and generatively re-engaged within contemporary design processes. Focusing on nomadic cultures rooted in Anatolia, and particularly on Yörük culture, the study approaches design not merely as a formal or functional outcome, but as a dynamic, relational, and cultural practice shaped through lived experience, spatial transformation, and adaptation.

Departing from design approaches that prioritize universality, standardization, and abstraction from context, the thesis argues that local knowledge systems constitute a critical yet unexplored source of design intelligence. Such systems encode adaptive strategies developed through long-term interaction with environmental, social, and temporal conditions. In mobility-based cultures, these strategies are not fixed but continuously recalibrated through movement, settlement, and reconfiguration, giving rise to a distinct form of design knowledge grounded in motion.

To address this gap, the study proposes an interdisciplinary framework that integrates phenomenological inquiry, visual grammar systems, and computational design thinking. Phenomenology provides the methodological grounding to uncover tacit knowledge embedded in lived experiences. Visual grammar enables the systematization of spatial and object-based transformations. Computational thinking offers a means to translate this systematized knowledge into generative and adaptable design logics. The thesis positions computation as a mediating interface through which cultural knowledge can be interpreted, structured, and re-articulated.

In line with the regulations of Istanbul Technical University regarding doctoral theses based on published work (LEE, 2020), this research is structured around three interrelated publications presented as Chapters 2 to 4. Each chapter addresses a distinct yet connected dimension of the study. These publications are framed and synthesized by the present Introduction in Chapter 1 and the concluding discussion in Chapter 5, which together establish the conceptual continuity and theoretical contribution of the thesis as a whole.

Within this context, the following section introduces the theoretical framework of the study and outlines the interrelated concepts of culture, design, and computational thinking that form the foundation for the analyses developed throughout the thesis.

1.1 Theoretical Framework of the Study

For the majority of human history, life was predominantly structured around mobility. Early human societies engaged with space as a dynamic and continuously reconfigured field shaped by movement, seasonality, and environmental adaptation. Within this context, spatial knowledge was not primarily externalized into permanent structures. Mobility, therefore, functioned not only as a mode of survival but as a fundamental framework for organizing perception, culture, and spatial understanding (Ingold, 2000; Leroi-Gourhan, 1993).

This condition was fundamentally altered with the transition to sedentary life, commonly referred to as the "Neolithic Revolution" (Childe, 1936; Hodder, 2011). This transformation marked a critical epistemic shift in which space became increasingly stabilized, bounded, and materialized through built environments. As human activities became concentrated in fixed locations, knowledge itself began to be externalized, accumulated, and organized within spatial and architectural structures. The adaptive, process-based, and relational qualities associated with mobility gradually gave way to systems oriented toward permanence, order, and formalization.

The Neolithic transformation also introduced significant shifts in human health, physiology, and social organization. Increased population density, closer proximity to domesticated animals, and the accumulation of waste contributed to the emergence and spread of infectious diseases (Diamond, 1997; Armelagos et al., 2005). Changes in diet associated with early agricultural practices further affected human physiology, leading to observable differences in nutrition, dental health, and bodily development. These transformations indicate that the transition to sedentary life was not limited to spatial or economic reorganization, but involved a broader reconfiguration of the human–environment relationship, extending to biological and social dimensions.

From a structural anthropological perspective, cultural systems are organized through relational patterns rather than static forms (Lévi-Strauss, 1963). Within this framework, the distinction between nomadic and sedentary cultures cannot be understood as a simple opposition, but rather as different modes of organizing movement, experience, and meaning. While mobility-based systems privilege adaptability, temporality, and relational organization, sedentary systems tend to stabilize, categorize, and materialize knowledge.

This perspective also resonates with vernacular environments and the notion of "architecture without architects," where spatial knowledge emerges through collective practices, accumulated experience, and continuous adaptation rather than formalized design processes (Rudofsky, 1964). Such environments demonstrate that complex and context-responsive spatial organizations can develop without centralized authorship, through distributed and embodied forms of intelligence. In this sense, vernacular and mobility-based spatial practices reveal alternative modes of design knowledge that remain largely tacit, process-based, and relational.

Taken together, these transformations suggest that the Neolithic Revolution can be understood as the beginning of a long-term epistemic trajectory that privileges stability over change. Modern architecture, in this sense, can be interpreted as an intensified manifestation of this historical trajectory.

Building upon this historical trajectory, the modernist architecture movement marked the beginning of a new era in architecture and design by producing responses to the needs of rapidly modernizing societies. The modernist understanding of functionality prioritized designs that served a particular idealized lifestyle. Within this framework, there was limited room for plurality or diversity, as societies were expected to conform to this idealized mode of living (Corbusier, 1985; Giedion, 1941). However, this approach led to a growing detachment from local contexts and cultural codes. Modernism's pursuit of universality resulted in the marginalization of local knowledge systems and design traditions (Frampton, 1983).

Beyond questions of functionality, efficiency, or aesthetics, modern design may also be understood as a political and ontological project that shapes which forms of life, knowledge systems, and spatial practices are recognized as legitimate. Design, in this sense, does not merely produce objects or environments; it participates in the production of particular realities and ways of inhabiting the world. Escobar (2018) argues that modern design has historically operated through universalizing assumptions that privilege singular ways of knowing, making, and dwelling, often at the expense of situated and culturally embedded alternatives. His notion of the pluriverse, described as "a world where many worlds fit," offers a critical framework for reconsidering marginalized knowledge systems not as residual traditions, but as valid and active modes of world-making (Escobar, 2018). From this perspective, mobility-based cultures such as the Yörüks may be understood not simply as historical

communities of adaptation, but as carriers of alternative design ontologies through which different relationships between humans, environments, objects, and temporality are articulated.

This perspective resonates with Arendt's understanding of plurality as a fundamental condition of political life. For Arendt, shared worlds do not emerge through sameness, but through the coexistence of different actors, perspectives, and forms of appearance within a common world (Arendt, 1998). As discussed in architectural interpretations of Arendt's work, the political dimension of the built environment is not limited to institutional structures, but extends to the material and spatial conditions through which plurality becomes visible and actionable (Teerds, 2022). In this sense, the marginalization of situated cultural knowledge systems may be understood not only as epistemological loss, but also as the narrowing of plural ways of world-making.

From the second half of the twentieth century onward, globalization, mass production, and standardization, together with the rise of consumer culture, weakened the value of design both as a process and as a product (Baudrillard, 1981). The modern ideal of life increasingly shaped design processes around economic and technological concerns, leading to design outcomes that were largely devoid of identity, disconnected from cultural memory, and oriented toward rapid consumption (Featherstone, 1995). The persistent disregard for knowledge systems rooted in local contexts caused traditional knowledge and craft practices to gradually disappear, particularly in cultures with long-standing design traditions (Appadurai, 1996; Sennett, 2008).

Standardization, as one of the core outcomes of modernism, produced a pronounced loss of identity in the field of design when combined with globalizing processes. Mass production and accelerated consumption positioned design objects primarily as functional tools, thereby eroding their cultural and aesthetic dimensions (Harvey, 1989). As a consequence, culture increasingly came to be perceived as a superficial or decorative element within design processes (Bhabha, 1994). This tendency contributed to the homogenization of traditional cultures within the global market economy and drove them toward ongoing processes of cultural transformation (Inglehart, 1971; Inglehart and Baker, 2000).

Within this study, a design approach detached from cultural context is addressed as a fundamental problem that weakens social identities. The separation of the design

process, and consequently the design product, from its cultural context has led to the erosion of local knowledge systems and to the loss of cultural meaning embedded in spaces (Lefebvre, 1991). This detachment is not merely methodological, but political. Decisions regarding which forms of knowledge are preserved, systematized, legitimized, or excluded are inherently political. As Arendt (1998) suggests, human worlds are constituted through shared conditions of action, plurality, and appearance, making the organization of collective life inseparable from political processes. From this perspective, the marginalization of vernacular, mobility-based, or tacit knowledge systems reflects not merely epistemological oversight, but broader political dynamics concerning visibility, legitimacy, and power. Reconsidering local design knowledge therefore involves more than documentation or preservation; it requires questioning dominant design paradigms and the conditions through which certain futures are privileged over others.

In response to this problem, the thesis proposes an approach that systematizes local knowledge through computational thinking and integrates it into computational design methodologies. At this point, it is important to clarify that the study does not seek to reproduce the full complexity of lived cultural experience within computational systems. Any attempt to engage culturally embedded, experiential knowledge within analytical and generative design frameworks necessarily involves abstraction. Within this research, however, abstraction is not approached as a universalizing or reductive mechanism, but as a deliberate interpretative act of mediation. Rather than treating computation as an epistemically neutral system of extraction, the study positions computational thinking as a mediating interface through which selected relational principles embedded in situated cultural practices may be translated into analytically legible and generatively operative forms. In this sense, abstraction is not treated as an unintended limitation of the study, but as a constitutive methodological condition that enables interpretation, systematization, and generative reinterpretation.

Computational thinking has emerged as a transformative cognitive framework that extends beyond its origins in computer science to influence creative disciplines such as architecture and design (Oxman, 1995; Oxman, 2005; Wing, 2006). As a systematic approach to problem solving, computational thinking enables designers to deconstruct complex cultural phenomena, identify underlying patterns, and reconfigure these patterns into design variations (Mitchell, 1993; Oxman, 2008). Through abstraction,

decomposition, and algorithmic reasoning, cultural values, rituals, and spatial practices can be distilled into design principles that remain contextually relevant (Eglash, 1999). In addition, computational tools allow for the analysis of large data sets, making it possible to reveal cultural patterns and spatial behaviors that inform evidence-based design decisions (Dominguez-Gómez and Celis, 2024; Tedre et al., 2006).

This approach does not reduce culture to a set of quantifiable parameters. Instead, it provides a framework for dynamic reinterpretation, through which traditional knowledge systems can be meaningfully integrated into contemporary design practices. By fostering an interactive relationship between technology, design, and culture, computational thinking enables design to function both as a reflection of cultural narratives and as their carrier. This perspective positions design as a process through which social and cultural meanings are constructed (Eglash et al., 2006; Oxman, 2005).

This discussion is both timely and necessary for reconsidering the reconnection of design with its cultural contexts through computational thinking. The notion of a return to context suggests that integrating computational thinking with local design cultures can enable design to occupy a more meaningful position within culture-oriented contextual frameworks. Accordingly, this study proposes a theoretical framework that aims to redefine and strengthen the conceptual relationships between design, culture, and computational thinking (Figure 1.1).

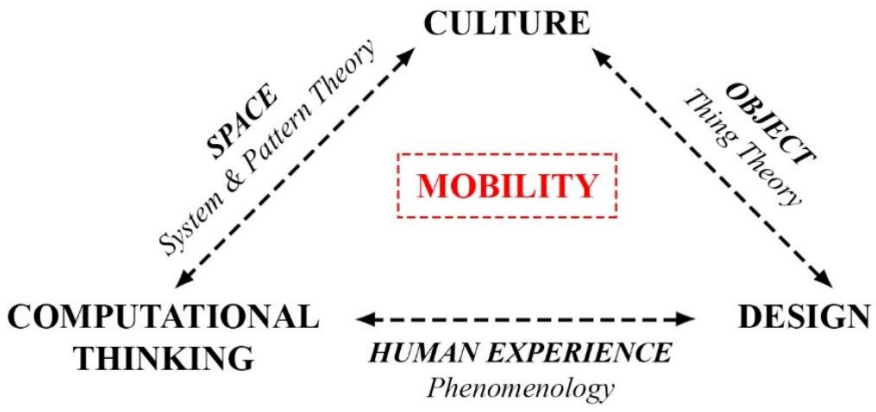

Figure 1.1: Tripartite theoretical framework of the study.

As illustrated in Figure 1.1, the proposed theoretical framework is structured around three relational axes that position *culture*, *design*, and *computational thinking* in a triangular configuration, with *mobility* functioning as the central mediating condition.

The following sections elaborate on each of these axes in detail, examining how mobility operates differently across the "Culture–Computational Thinking", "Culture–Design", and "Design–Computational Thinking" relationships.

1.1.1 Culture-computational thinking axes

Culture encompasses tools, objects, and practices that directly or indirectly serve human needs, together with customs and bodily or intellectual provisions (Malinowski, 2014; Oğuz, 1976; Taylor, 1873). Beyond individual beliefs and values, culture includes relationships among individuals, interactions with the environment, and the organizational structures of communities (Geertz, 1973). From this perspective, culture can be defined as a dynamic system composed of interconnected subsystems such as language, art, technology, economy, religion, and morality (Parsons, 1951). Continuous interaction among these subsystems produces the multilayered and variable character of culture.

Culture is not a static entity. It evolves through ongoing interactions with environmental conditions, social relations, and technological developments. This evolutionary process is sustained by feedback mechanisms that shape and stabilize social norms (Luhmann, 1995). Individual and collective behaviors are reflected back into society, where they are gradually transformed into shared norms. Through continuous exchanges of information, energy, and resources with its surroundings, culture renews itself over time. It therefore operates as an open system in constant interaction with environmental and social factors, rather than as an isolated or closed structure (Bertalanffy, 1968).

Such a characterization aligns with the foundational principles of system theory, which provides an interdisciplinary framework for comprehending the dynamic, contextual, and holistic nature of complex systems (Bertalanffy, 1968). System theory focuses on the relationships among system components, the structures they form, and their interactions with the environment. Among its key contributions are the ability to clarify complex structures, encourage interdisciplinary perspectives, and support the development of sustainable solutions (Checkland, 1999). Norbert Wiener's foundational work in cybernetics further emphasized similarities between biological and mechanical systems by foregrounding the roles of information flow and feedback (Wiener, 1948). Wiener demonstrated that both organisms and machines operate

through processes of information exchange that shape system behavior. In a similar manner, culture regulates itself and adapts to change through feedback mechanisms, reinforcing its systemic character.

Within system theory, entropy refers to a system's tendency toward disorder. As a system, culture is also susceptible to entropy over time. Cultural entropy arises when order weakens and norms, values, and meanings become ambiguous or excessively complex (Beaudreau, 2006). This condition may be triggered by rapid social change, the erosion of shared norms, globalization, or the increasing density of information driven by technological acceleration. Under such circumstances, cultural systems may struggle to restore coherence through internal mechanisms alone. Nevertheless, cultures continuously develop regulatory mechanisms aimed at mitigating entropy and sustaining order (Beaudreau, 2006; Breakwell, 1986).

Norms, social values, and rituals play a central role in reducing cultural entropy and maintaining social balance. These mechanisms guide individual behavior and regulate systemic functioning, underscoring the normative dimension of culture. As a normative system, culture fulfills the fundamental requirement of social order. Without shared rules that stabilize behavioral variability, social systems become fragile and ultimately meaningless (Bicchieri, 2006; Cialdini et al., 1991). By standardizing actions, culture generates behavioral patterns that individuals tend to repeat unconsciously. Over time, these patterned behaviors evolve into customs that define the rhythm of social life and reveal the patterned structure of culture.

Pattern theory offers a significant conceptual framework for understanding culture as a systematic structure organized through recurring and meaningful patterns (Alexander, 1999). According to this perspective, culture is expressed through repeated behaviors, rituals, and social interactions that shape collective identity. By identifying and analyzing such recurring elements, pattern theory provides a method for interpreting cultural phenomena. These patterns manifest in everyday practices, ceremonies, and interactions, reflecting a society's values and modes of organization. As such, pattern theory enables the systematic analysis, interpretation, and representation of cultural regularities (Alexander, 1999; Habraken, 1998).

Complexity suggests that a system is composed not of predictable components but of dynamic interactions among its elements (Cilliers, 1998). In mathematical terms, this

implies that one plus one does not necessarily equal two. Accordingly, culture does not operate as a linear system. Its inputs and outputs are not always predictable. System theory and pattern theory therefore provide complementary tools for analyzing and interpreting this nonlinearity and complexity.

Computational thinking emerges as a contemporary mode of thought particularly relevant to disciplines such as architecture, design, and the social sciences, where problems are often ill-defined (Newell and Simon, 1972). It offers a methodological approach for analyzing complex processes and managing uncertainty. From this perspective, culture can be understood not only as a system but also as a data ecosystem, in which information flows, interactions, and feedback loops can be examined and interpreted (Wing, 2006). Computational thinking enables the development of algorithmic reasoning capable of addressing complexity within cultural systems. By combining pattern theory's capacity to interpret recurring cultural structures with system theory's emphasis on openness and dynamics, computational thinking supports deeper analyses of cultural transformation.

In conclusion, integrating culture's pattern-oriented perspective with the problem-solving capacities of computational thinking strengthens the understanding of culture as a systematic and dynamic structure. This integration offers a new paradigm, particularly for interdisciplinary research, enabling the analysis of cultural transformation while supporting the development of adaptive strategies for cultural continuity and preservation.

1.1.2 Culture-design axes

Design emerges within cultural structures that shape everyday practices, values, and modes of living. As one of the physical and symbolic expressions of a society, embodies its cultural values, norms, traditions, and ways of life (Geertz, 1973). In this sense, design not only emerges from culture but also functions as a transformative and innovative representative of it. Local craft practices and traditional modes of making and living, understood as local knowledge systems, reflect a society's aesthetic sensibilities and historical accumulation. Through design, these practices can be reinterpreted and reproduced within contemporary contexts (Ingold, 2000). Such tangible manifestations of culture play a critical role in carrying cultural legacies from the past into the future and in sustaining cultural continuity (Hall, 1997). At the same

time, these tangible indicators do not merely represent material culture. They also reveal intangible heritage, including embodied behaviors, preferences, and modes of making, which become legible through material form (Smith, 2006).

Culture constitutes the context in which human behavior, social relationships, and societal norms are formed, while design operates as the material articulation of this context. By responding to aesthetic, functional, and social needs, design renders cultural norms and values visible. Designs grounded in traditional making practices function as archives of social relations, physical environments, and cultural identities (Bourdieu, 1990). However, design does not simply mirror existing cultural conditions; it also provides questioning, redefinition, and, at times, the transformation of cultural boundaries. This reciprocal relationship establishes a continuous dialogue through which culture and design shape one another. While design carries values inherited from the past into the future, it simultaneously acts as a catalyst for cultural change (Hobsbawm and Ranger, 1983). Within contexts marked by social transformation, technological development, and shifting aesthetic sensibilities, the role of design as a medium of cultural expression becomes increasingly significant. In this sense, culture provides meaning, depth, and context for design, while design operates both as a carrier and as a transformer of culture (Latour, 2005).

Thing theory approaches objects not merely as functional tools but as cultural carriers, producers, and representatives. This perspective highlights the dynamic relationship between culture and objects (Brown, 2001). Objects are not only material entities. They also embody cultural values, historical accumulation, and social meanings, thereby materializing aspects of intangible heritage (Kopytoff, 1986). A Japanese teapot, for instance, functions not simply as a utilitarian object but as a material expression of tea-drinking rituals, attentiveness to the present moment, and culturally embedded habits (Sen, 1979). Examining objects through their cultural dimension allows for an understanding of both their functional attributes and the meanings they carry, as well as the design decisions embedded within them (Tilley, 1994). The notion of “thingification” describes the process through which objects acquire meanings beyond their original contexts of use. In this regard, a Yörük woven rug, for example, extends beyond its function as a floor covering and embodies the labor of the Yörük community. Such “things” function simultaneously as cultural archives and as mechanisms through which culture is reproduced (Ingold, 2013). At the same time,

they operate as anchors of cultural memory, enabling continuity even under conditions of displacement.

Objects also function as expressions of cultural identity. The things used within a particular culture reflect its social identities, value systems, and historical circumstances. Traditional clothing, for instance, does not merely represent an aesthetic preference. It conveys information about a community's history, social structure, and worldview. Objects therefore do not only reflect culture. They actively participate in shaping it (Miller, 2008). The capacity of objects to transform cultural practices arises from the interaction between their symbolic and material dimensions, which influences patterns of use and social behavior (Ihde, 1990). This transformative potential underscores the role of objects in cultural expression and deepens the interdependence between culture and design (Gell, 1998)

Within the scope of this study, things are approached as transmitters that allow culture to materialize rather than remain abstract. Objects are thus evaluated not solely as historical documents or functional artifacts but as active elements that contribute to cultural continuity (McDonnell, 2016). While objects serve as archives of past practices, they also play a crucial role in preserving and transmitting cultural identities. In this respect, design processes and design decisions are as significant as the final physical form of objects. Transmitting a design object independently of its production process does not ensure cultural continuity. Instead, it risks producing superficial imitation rather than meaningful transmission (Ingold, 2020). The Encyclopédie by Diderot and d'Alembert provides a notable historical example of how production processes, operative rules, and artisans' decision-making were visually and textually documented. The Encyclopédie sought to reveal the order and interconnections of human knowledge by detailing how mechanical actions were performed, thereby capturing both their content and underlying logic (Gürer, 2014). From this perspective, the study adopts an approach that considers objects within an inclusive understanding of design and production processes as a means of cultural transmission.

Accordingly, this study frames the reinterpretation of production processes, local knowledge systems, and the cultural contexts of objects as a critical step toward cultural sustainability. By revisiting and critically examining traditional methods of making, the research does not merely aim to preserve intangible heritage. It also seeks

to reassess and translate this knowledge into contemporary, context-based, and original design knowledge systems.

1.1.3 Design-computational thinking axes

Lived experience is a critical notion for understanding how interactions between individuals, spaces, and objects contribute to both individual and collective processes of meaning making. While computational thinking introduces an algorithmic and systematic perspective into the design process, the ways in which these processes intersect with cultural and contextual layers can be examined more deeply through lived experience. Within this framework, the study addresses this intersection through a phenomenological theoretical approach.

Phenomenology proposes the temporary suspension of a priori knowledge in order to focus primarily on the experienced object itself. The motivation of this approach is to remove preconceived assumptions that may disrupt the unity between subject and object, allowing direct experience to function as the primary source of knowledge. As articulated by Husserl (2001), the guiding principle of phenomenology is to return to the things themselves. Husserl (1970) defines this methodological suspension of the natural attitude as epoché. Through phenomenological suspension, experience is understood as co-constituted by the object and the subject's consciousness. Rather than reinforcing a strict subject–object dichotomy, phenomenology enables an interpretative framework in which subject and object cannot be fully separated from one another (Gadamer, 1982; Ricoeur, 1981; Winograd and Flores, 1986).

From this perspective, phenomenology establishes a conceptual foundation in which design is understood not merely as a functional or technical solution, but also as a carrier of cultural memory and social meaning articulated through lived experience. Gürer (2014) emphasizes that the aim of phenomenological interpretation is not to transform subjective experience into objective data, but rather to render tacit understanding explicit. Tacit knowledge refers to forms of knowing that are difficult to articulate or transmit through written or verbal means. Such knowledge is grounded in experience, intuition, skills, and embodied insight. Unlike explicit knowledge, which can be readily codified and shared, tacit knowledge remains deeply personal and situational. The process of revealing tacit knowledge can therefore be understood

as translating what is ineffable into forms that can be described, interpreted, and communicated.

Intangible cultural elements, together with their tangible counterparts, namely things, embody accumulated experiences derived from everyday practices, yet they often remain tacit. This study emphasizes the necessity of a phenomenological theoretical foundation in order to uncover such forms of knowledge. Rather than focusing solely on physical objects within design processes, this approach attends to how objects are perceived, experienced, and interpreted by users (Husserl, 2001). This understanding is extended into social and cultural domains, positioning phenomenology as a method capable of addressing the multilayered structure of human experience (Zahavi, 2003, 2005).

At this point, phenomenology enables the differentiation of the layers of lived experience and the recognition of elements that possess pattern-forming qualities. It also provides a framework for identifying regularities, relational structures, and contextual constants embedded in cultural experience that often remain at an intuitive level. This process of differentiation serves to determine which dimensions of experience are abstractable, patternable, and transferable into a rule-based system. Accordingly, phenomenology can be positioned as a philosophy that defines the boundaries and conditions of applicability of computational thinking.

Computational thinking introduces an interdisciplinary mode of inquiry that encompasses problem solving, pattern recognition, and algorithmic reasoning (Wing, 2006). However, its application within design processes requires attention not only to technical operations but also to experiential and contextual dimensions. From this standpoint, a phenomenological approach to design can enrich computational thinking in multiple ways. In problem-solving contexts, Husserl's notion of epoché supports the examination of users' experiences and contextual conditions by suspending preconceived assumptions. Dreyfus (1991) similarly underscores the importance of situating user experience within its lived context rather than treating it as an abstract variable. When combined with Alexander's (1999) pattern theory, a phenomenological perspective can contribute to design outcomes that are responsive not only in functional terms but also in experiential and cultural dimensions.

In conclusion, integrating phenomenological design approaches with computational thinking enables a redefinition of design as more than a technical problem-solving activity. It positions design as a practice through which contextual and cultural meaning is produced. This intersection offers an integrative framework that brings together technical systems and cultural interpretation. Within this framework, pattern theory's emphasis on order and systematic structure is complemented by thing theory's attention to the social and cultural meanings embedded in objects. Phenomenology deepens this synthesis by situating these elements within the realm of lived experience and perception. Together, pattern theory, thing theory, and phenomenology provide a coherent theoretical foundation for understanding the complex relationships among objects, spaces, and human experience.

1.1.4 Mobility: A conceptual connector at the intersection of culture, computational thinking, and design

Mobility is a multifaceted contemporary phenomenon situated at the intersection of the lifestyles and physical movements of individuals, groups, and societies. It evolves continuously in relation to technological, social, and economic developments. Merriman (2012) identifies mobility as a fundamental element of social and spatial thought, emphasizing its pervasive presence. In its broadest sense, mobility can be defined as both the capacity and the necessity to move from one place to another, highlighting the extent to which everyday practices are shaped by movement and change (Barnard and Wendrich, 2008). Contemporary events such as pandemics, wars, and global crises repeatedly expose the instability of markets, belief systems, political structures, and social relations. In this context, Thrift (1996) conceptualizes mobility as a structure of feeling that mediates relationships among people, places, objects, and entities. Its significance emerges from its function as a mode of communication through which individuals and societies respond to changing conditions. Rather than remaining anchored to fixed positions, adaptation increasingly occurs through mobility understood as a communicative and relational practice.

These conditions also reveal that mobility is not experienced equally, nor is adaptation politically neutral. Movement may function as freedom, necessity, displacement, precarity, or survival, depending on socio-political conditions. Contemporary mobility therefore cannot be understood solely through flexibility or technological

transformation, but must also be situated within broader questions of inequality, ecological uncertainty, and contested futures. In this sense, mobility is not merely a logistical condition, but a politically charged framework through which relations between bodies, territories, infrastructures, and environments are negotiated.

The capacity to adapt through mobility is evident in contemporary everyday practices. From inhabiting furnished studio apartments to working in shared offices or attending online meetings from cafés, much of present-day life reflects an ongoing effort to reduce dependence on fixed places, objects, habits, and routines. These transformations encourage modes of living that prioritize flexibility and movement, giving rise to what has been described as new forms of nomadism (Hennessey and Papanek, 2008). From a spatial perspective, concepts such as home and workplace are no longer tied to fixed physical locations. These spaces operate as mobile constructs that are continuously assembled, dismantled, and reconfigured through memory and experience. As a result, everyday life no longer functions as a stable collection of objects but resembles a process of ongoing relocation shaped by mobility-driven practices (Gospodinov, 2015). Within this condition, individuals may be understood as new nomads who engage with change proactively and explore its boundaries (Ehmann et al., 2015).

Understanding contemporary mobility does not require exceptional circumstances such as pandemics or crises alone. Human biology itself demonstrates that movement, change, and adaptation are fundamental conditions of life, prompting attention toward cultures that maintain enduring and adaptive relationships with their environments (Schwartz-Clauss et al., 2002). From this perspective, examining mobility-based cultures of the past offers valuable insights for understanding present conditions. This approach does not aim to replicate historical nomadic practices such as the seasonal migrations of the Yörüks in search of grazing lands, the commercial routes of Silk Road traders, or the navigational practices of Bedouin communities. Instead, it seeks to draw upon mobility-centered traditions embedded within cultural codes as sources of adaptive knowledge relevant to contemporary contexts.

Conceptualizing mobility as a cultural and adaptive strategy extends its relevance beyond purely historical or traditional frameworks. Mobility encompasses not only physical movement but also dynamic interactions among objects, spaces, and human experiences. This perspective underscores that mobility-based cultures are not static

remnants of the past but evolving systems of knowledge and practice. Studying such systems provides insights into current challenges related to environmental and cultural sustainability. Within this framework, the Yörüks, a community historically rooted in a mobility-centered lifestyle in Anatolia, offer a critical lens through which the interrelations among space, objects, and lived experience can be examined under changing cultural and environmental conditions.

The Yörüks constitute the primary focus of this study. The term "Yörük" derives from the verb yürü, meaning to walk, combined with the suffix -k, referring to individuals who engage in movement as a habitual practice or way of life (İnalcık, 2014). This definition emphasizes mobility as a lifestyle rather than an ethnic classification (Beşirli and Erdal, 2008). Traditionally associated with pastoralism, Yörük communities relied on continuous movement in search of fertile grazing lands, necessitating adaptive spatial and material practices (Doğan and Doğan, 2004). Although many Yörüks have adopted sedentary lifestyles in contemporary contexts, some groups continue to maintain mobility-based traditions. Processes of modernization, urbanization, economic transformation, education, cultural assimilation, political change, environmental pressures, and geographical constraints have placed Yörük culture at significant risk. These conditions generate ongoing threats of cultural, identity-based, and traditional loss, underscoring the urgency of documenting and sustaining this knowledge.

This study traces mobility-based design traditions through the experiential practices of the Yörüks. Defining a community as mobile implies that all design-related elements within that community, including objects, spaces, and human experiences, are shaped by mobility-oriented conditions. The significance of this research lies in uncovering tacit design knowledge accumulated through long-term cultural experience and refined through everyday practices exposed to real environmental and social constraints. Mobility is conceptualized here as a condition of being in motion across time and space, emphasizing both the preservation and the reinterpretation of mobility-based experiential knowledge.

Ultimately, the study seeks to reveal traditional design knowledge rooted in mobility-based cultural practices intrinsic to the Anatolian context. By examining the experiential accumulation embedded in Yörük daily life, the research addresses design across multiple scales through the human experience–space–object triad. Through the

identification and systematization of mobility-based design knowledge, the study aims to contribute to the diversification of contemporary design knowledge by drawing upon the mobility-centered traditions of nomadic cultures that form a foundational component of Anatolian cultural heritage.

1.2 Problem Statement

Yörük culture is most commonly approached through its social and ethnographic dimensions. This study, however, examines Yörük culture from a design-oriented perspective, focusing on the knowledge embedded in everyday practices, objects, spaces, and lived experiences. In particular, it reconsiders the design intelligence generated through mobility-based ways of living within the framework of design theory. Furthermore, the study explores the potential of translating mobility-based cultural knowledge into forms that can be modeled, systematized, and applied within contemporary design processes.

In addition, the study addresses the integration of local and culturally embedded knowledge systems into computational design approaches. While computational methods are increasingly employed in design research, their application often remains detached from cultural context. The translation of mobility-based intangible heritage into computable, rule-based, and generative design knowledge that retains its cultural specificity remains largely unexplored. As a result, both the experiential richness of nomadic cultures and their adaptive design strategies risk being reduced to descriptive accounts rather than contributing to contemporary design knowledge production.

In response to this research orientation, this study aims to investigate the design knowledge emerging from the Yörüks' mobility-centered lifestyle through the human experience–space–object triad. The research conceptualizes mobility as a temporal and experiential condition and examines how this condition shapes spatial organization, object adaptation, and everyday decision-making practices. The scope of the study encompasses a sequence of interconnected steps that move from revealing mobility-based intangible heritage, to systematizing this knowledge, and ultimately to generating new design possibilities that depart from it.

First, the study seeks to reveal the tacit design knowledge embedded in Yörük daily life by examining lived experiences, spatial practices, and object use across time.

Second, it aims to systematize the revealed knowledge by identifying recurring patterns and relationships and translating them into a theoretical and visual grammar system. This system, referred to as the in-motion visual grammar, is developed to explain how Yörük communities organize space, adapt objects, and negotiate daily life while in motion. Third, the study aims to generate design knowledge by employing this grammar as a basis for computational and visual rule-based interpretations that can inform contemporary design processes.

The knowledge produced through this approach is significant not only for the preservation and visibility of mobility-based intangible heritage, but also for contributing culturally grounded perspectives to modern design methodologies. By linking local knowledge systems with computational thinking, the study positions mobility-based design traditions as active sources of innovation rather than as static cultural artifacts.

Based on these objectives, the study is guided by the following research questions:

RQ-1 (Revealing): What if the knowledge embedded in the lived experiences of the Yörüks were revealed through an analysis of spatio-temporality to identify mobility-based design phenomena?

RQ-2 (Systematizing): How have Yörük tent groups been organized spatially, and what patterned logics, adaptive strategies and environmental reasoning underlie their arrangement within nomadic settlement practices?

RQ-3 (Generating): How can vernacular architectural knowledge be revealed through visual grammar, and how can this grammar be used to integrate such knowledge into generative design systems?

1.3 Purpose

This study aims to investigate the mobility-based design practices of the Yörüks, a prominent representative of nomadic culture in Anatolia, in order to reveal the tacit design knowledge embedded within these practices, to systematize this knowledge, and to generate culturally grounded design knowledge applicable to contemporary design processes. Deeply rooted in Anatolian culture and shaped by temporal and spatial mobility, Yörük design culture has progressively lost its visibility under conditions of modernization and globalization. In response to this risk of cultural

erosion, the study seeks to reestablish the connection between cultural context and design by repositioning mobility-based intangible heritage as a source of design intelligence.

The research adopts a phenomenological approach to reveal mobility-based phenomena emerging from the lived experiences of the Yörüks. Through an examination of everyday practices, spatial arrangements, and object use, the study focuses on uncovering experiential and temporal dimensions of mobility that remain largely implicit. Building upon this revealed knowledge, the research then aims to systematize the spatial and experiential transformations associated with a mobility-centered lifestyle by translating them into a visual grammar framework. This framework, conceptualized as an in-motion visual grammar, is developed to articulate how spaces are organized, objects are adapted, and decisions are made under conditions of continuous movement.

In its final phase, the study aims to generate new design knowledge by employing the visual grammar as a basis for interpreting and reconfiguring mobility-based design parameters. By identifying rule-based relationships embedded in objects adapted to mobility, the research facilitates the generation of new design variations that remain connected to their cultural origins. Accordingly, the thesis is structured around a human experience–space–object triad, in which the outcome of each phase functions as the input for the next. This sequential and iterative structure establishes a coherent research process that moves from revealing, to systematizing, and finally to generating design knowledge.

Beyond preservation, the primary purpose of this study is to address the limited presence of intangible cultural heritage within contemporary design discourse. Traditional knowledge systems, often confined to local contexts, remain underrepresented in global design practices. By focusing on Yörük design culture, the study aims to contribute to the preservation, documentation, and reinterpretation of Anatolia's mobility-based cultural heritage while positioning it within an international design framework. Furthermore, by integrating traditional knowledge with computational and visual design tools, the research seeks to enrich contemporary design methodologies with culturally embedded values and adaptive strategies. Ultimately, the study aspires to restore the fragmented relationship between design and

cultural context and to support sustainable knowledge production that bridges mobility-based traditions with contemporary design practice.

1.4 Hypothesis

The hypotheses of this research are formulated in alignment with the study's three-phase framework of revealing, systematizing, and generating mobility-based design knowledge.

Hypothesis 1 (Revealing): The tacit knowledge embedded in the lived experiences of the Yörüks' mobility-centered lifestyle can be revealed through an analysis of spatio-temporality, allowing mobility-based design phenomena to be identified and articulated.

Hypothesis 2 (Systematizing): The spatial organization of Yörük tent groups reflects patterned logics, adaptive strategies, and forms of environmental reasoning that can be systematically described, revealing recurring spatial arrangements within nomadic settlement practices.

Hypothesis 3 (Generating): Vernacular architectural knowledge revealed through a visual grammar framework can be integrated into generative design systems, enabling the production of culturally grounded yet contextually adaptable design variations.

1.5 How Can Mobility-Based Knowledge Be Revealed, Systematized, and Generated? An Overview of the Thesis Structure

This thesis is structured around three interrelated research phases aligned with its core research questions. The first phase focuses on revealing the knowledge embedded in the lived experiences of the Yörüks by analyzing spatio-temporality in order to identify mobility-based design phenomena. The second phase examines how Yörük tent groups are spatially organized and systematizes the patterned logics, adaptive strategies, and environmental reasoning underlying nomadic settlement practices through a visual grammar framework. The third phase employs this visual grammar as a generative framework, enabling the integration of vernacular architectural knowledge into contemporary design explorations and the production of culturally grounded yet adaptable design variations. These phases are articulated through a human experience–

space–object triad, in which each phase builds upon the outcomes of the previous one, establishing a coherent, sequential, and iterative research process.

The first phase of the thesis focuses on revealing mobility-based design knowledge by establishing the theoretical and phenomenological foundations of the study. Drawing on "*Unveiling Nomadic Utopias: Phenomenological Insights into the Spatio-Temporality of Yörük Culture"*, this phase conceptualizes Yörük nomadism as a living epistemology rather than a residual cultural condition, positioning mobility as a spatio-temporal mode of dwelling through which space is continuously produced. Within this framework, mobility is understood not as movement alone but as an experiential condition shaped by temporality, embodiment, and ecological attunement.

This phase begins with a critical engagement with literature on nomadism, mobility, and spatial theory, identifying the limitations of sedentary and object-centered paradigms in accounting for design knowledge derived from lived experience. In response, a phenomenological methodology is employed to examine how mobility is experienced, perceived, and enacted through everyday practices of the Yörüks in Anatolia. Using field observations, sketches, and narrative documentation, the analysis foregrounds tacit knowledge as it circulates through bodily routines, material engagement, and collective memory.

To render this tacit knowledge analytically legible, the phase introduces four interrelated phenomenological phenomena-cell, provision, transition, and nomad-which operate as conceptual lenses for revealing how spatial intelligence emerges through mobility-based lifeways. Rather than treating space as a fixed or predefined entity, this approach frames Yörük spatiality as a processual and relational condition, continuously reconstituted through movement, settlement, care, and adaptation. In doing so, the first phase establishes the epistemological ground for understanding nomadic life as a generative source of design knowledge, setting the stage for its subsequent systematization and generative reinterpretation.

The second phase of the thesis shifts its focus from lived experience to the spatial organization of Yörük nomadic practices as a mobility-based heritage system. Drawing directly on the findings of "*A Heritage Ecosystem in Motion: Yörük spatial practices and the ecology of mobility"*, this phase examines how mobility is articulated

through patterned spatial arrangements, adaptive strategies, and environmental reasoning embedded in the organization of Yörük tent groups.

Based on a comparative visual analysis of multiple settlement instances, a visual grammar framework is introduced as an analytical and representational tool to systematize these recurring spatial logics. This framework operates through three interrelated parameters: positional patterning, componential layout, and flow and transition paths. In this way, spatial decisions shaped by mobility are made comparable across different environmental and temporal contexts. Particular attention is given to transitional conditions between mobile and relatively stable states, such as moments of settlement, gathering, and circulation, which are understood as constitutive components of nomadic dwelling rather than temporary interruptions.

Through this analysis, consistent relationships among fundamental spatial elements, including tents, livestock areas, open spaces, and circulation zones, are identified and formalized as a set of rule-based patterns. These rules reveal how mobility functions as a cultural logic that generates adaptable yet persistent spatial configurations. In this way, the visual grammar operates as a mediating structure that translates tacit, mobility-based spatial knowledge into a systematic spatial framework, positioning Yörük settlements as living heritage ecosystems rather than transient or residual forms of inhabitation.

The third phase of the thesis extends the visual grammar framework from the scale of spatial organization to the scale of objects by examining how mobility-based design principles are embedded in the material culture of the Yörüks. Drawing on the "*Integrating vernacular architectural knowledge into genetic algorithms: A case study on Karaçadır"*, this phase focuses on objects as carriers of vernacular architectural knowledge shaped by mobility, adaptability, and environmental responsiveness. In this context, characteristics such as portability, modularity, adaptability, and multifunctionality are examined not as isolated attributes, but as outcomes of a systematically evolved design intelligence rooted in nomadic life.

Using the visual grammar and rule-based design logic developed in the second phase, key design parameters including form, material selection, component hierarchy, connection strategies, and assembly sequences are extracted and formalized. These parameters are treated as vernacular design constants derived from empirical findings.

Through the abstraction of these constants into a rule-based and computationally operable framework, vernacular architectural knowledge is translated into inputs suitable for generative design systems.

By embedding vernacular rules and constraints directly into the generative process, the study demonstrates that new design variations can be produced that remain structurally coherent, culturally grounded, and contextually adaptable. In this way, objects are positioned not merely as functional artifacts, but as operative interfaces through which mobility-based design intelligence is carried forward into contemporary generative design exploration.

Overall, the thesis is structured into five chapters. Chapter 1 and Chapter 5, namely the Introduction and Conclusion, are authored as integrative sections that frame and synthesize the research. Chapters 2, 3, and 4 correspond to three peer-reviewed scientific publications and represent the core investigative phases of the study, focusing respectively on revealing, systematizing, and generating mobility-based design knowledge. This structure complies with the regulations of Istanbul Technical University Graduate School for doctoral theses developed from multiple published works (LEE, 2020). Together, these chapters form a complementary and coherent whole that models mobility-based intangible heritage through Yörük spatial practices (Table 1.1).

Table 1.1: Research design.

Chapter Number and Name	Hypotheses	Section Organization	Method	Purpose
CHAPTER 1 *Introduction*	Design can be reconnected to cultural meaning by integrating *culture–design–computational thinking* through **mobility** as a conceptual connector.	*From theoretical framework → culture–computational thinking → culture–design → design–computational thinking → mobility connector → problem – purpose → hypothesis → thesis structure.*	Theoretical synthesis, literature review, conceptual modeling.	To establish a tripartite conceptual foundation (culture–design–computation) and position mobility as the core analytical lens for the entire dissertation.
CHAPTER 2 *Unveiling Nomadic Utopias: Phenomenological Insights into the Spatio-Temporality of Yörük Culture*	Nomadic mobility contains tacit spatial knowledge that can be phenomenologically revealed and reframed as a living design utopia.	*Utopian theory → nomadism → phenomenology → four experiential phenomena (cell, provision, transition, nomad) → design utopia synthesis.*	Phenomenology, experiential pattern extraction, narrative–diagrammatic reading.	To reveal mobility-based cultural intelligence and reinterpret it as a design-relevant epistemology.

Table 1.1 (continued): Research design.

Chapter Number and Name	Hypotheses	Section Organization	Method	Purpose
CHAPTER 3 *A Heritage Ecosystem in Motion: Yörük Spatial Practices and the Ecology of Mobility*	Yörük settlements operate as mobility-based heritage ecosystems whose spatial logic can be formalized into rule-based visual grammar.	*Heritage ecosystem framing → hybrid dataset → in-motion visual grammar → spatial rules (R1–R9) → implications.*	Diagrammatic abstraction, hybrid visual dataset, three-parameter spatial analysis, in-motion visual grammar	To systematize mobile heritage via visual grammar and extract explicit spatial rules.
CHAPTER 4 *Integrating Vernacular Architectural Knowledge into Genetic Algorithms: A Case Study on Karaçadır*	Vernacular architectural knowledge contains implicit optimization logic that can be encoded through RBD and integrated into genetic algorithms.	*GA problem → VAK definition → RBD rules → genotype encoding → GA model → optimization outcomes.*	Rule-Based Design (RBD), genotype encoding, genetic algorithms simulation with culturally defined constraints.	To embed vernacular architectural logic into computation and generate culturally coherent GA variations.

Table 1.1 (continued): Research design.

Chapter Number and Name	Hypotheses	Section Organization	Method	Purpose
CHAPTER 5 *Conclusion*	Mobility-based design knowledge, revealed through lived experience, systematized via visual grammar, and generated through computational methods, constitutes a coherent and transferable form of design intelligence.	*Synthesis of three publications → 5.1 synthetic evaluation across experiential, spatial, and object scales → articulation of theoretical, methodological, and design-oriented contributions → applicability, limitations, and future research directions.*	Synthetic evaluation of phenomenological findings, visual grammar frameworks, and generative computational outcomes.	To consolidate the tripartite research structure, validate its internal coherence, and position mobility-based intangible heritage as a design-relevant knowledge model applicable beyond the Yörük case.

2. UNVEILING NOMADIC UTOPIAS: PHENOMENOLOGICAL INSIGHTS INTO THE SPATIO-TEMPORALITY OF YÖRÜK CULTURE[1]

2.1 Introduction: Need for Utopias in Architecture

The theories that have historically shaped architectural discourse are predominantly grounded in sedentary worldviews that glorify mechanization, standardization, and, to a great extent, permanence (Corbusier, 1985; Greenhalgh, 1990). From urban planning to building typologies, from spatial organization to the anthropometry of the human body, the "standardized" has been inscribed as a foundational principle of spatial production (Littlefield, 2011; Neufert and Neufert, 2012; Pheasant and Haslegrave, 2006; Tilley and Dreyfuss, 2001). Standardization, reinforced by industrialization, rapidly advancing technologies, and new modes of production, has profoundly transformed the built environment, producing distinct sociological effects (Berman, 1988). Deeply embedded within the dominant canon of architectural thought, these paradigms have positioned architecture as a discipline governed by rigid and prescriptive rules, largely excluding dynamic elements such as movement, transience, and transformation.

However, the limitations of this rationalist framework have become increasingly evident, both in theoretical discourse and lived experience. Drawing on critiques articulated by Heidegger and later interpreted through Foucault and Derrida, Pallasmaa argues that modernism, by privileging abstraction, ultimately reinforces its own epistemological limitations (Pallasmaa, 2008). As Tafuri (1979) argues, the modernist project was far from a neutral technical endeavor; rather, it was instrumentalized as a political and economic tool that embedded rationalist ideology. Contemporary global crises, including pandemics, war, climate collapse, and mass displacement, have laid

[1] This chapter is based on the article: Uçar U.E., Gürer E., Unveiling Nomadic Utopias: Phenomenological Insights Into The Spatio-Temporality Of Yörük Culture, accepted [2026], [© 2026 Utopian Studies: The Journal of the Society for Utopian Studies]

bare the insufficiencies of this standardized, mechanistic, and static spatial "utopia". Space can no longer be conceived as a permanent entity; instead, it must be understood as a responsive, relational, and temporally fluid process.

This shifting everyday practices incline us all toward a more nomadic mode of existence (Hennessey and Papanek, 2008). From a spatial perspective, the notion of “home” or “workspace” is no longer confined to a permanent, material location; rather, it has become an idea we carry with us, a mobile construct we continuously build, dismantle, renovate, and occasionally fortify through memory. These mobile spaces, composed of the sum of our lived experiences, no longer resemble a catalog of objects as they once might have. On the contrary, our everyday life has become a “catalog of moving,” a mobility-based archive constituted by human behaviors and the experiential residues of daily life (Gospodinov, 2015). In this light, it becomes possible to identify ourselves as “new nomads” those who adopt change early and trace its thresholds as pathfinders of the emerging spatial paradigm (Klanten et al., 2015).

This reorientation toward mobility in contemporary life invites a reconsideration of those communities for whom movement has always been a way of being. Lifeways traditionally grounded in seasonal rhythms, ecological attunement, and relational modes of spatial inhabitation, namely nomadic cultures, embody not merely a resistance to permanence, but an alternative epistemology of spatial production (Barnard and Wernich, 2008; Gilbert, 2014). Nomadic life is attuned to nature, temporality, and collective rhythms; it fosters forms of making that are sustainable, reconfigurable, and open to transformation, practices that resonate deeply with the multi-scalar crises of our time and offer fertile ground for imagining new utopias.

2.2 Methodology

2.2.1 Material and cultural context

Multiple forms of nomadism persist within mobile cultures in modernity, among which pastoral nomadism constitutes a distinct category organized around mobility centered on livestock care and herd management (Gilbert, 2014). In this way of life, movement patterns are shaped by ecological rhythms and animal welfare (Barfield, 2012; Barnard and Wernich, 2008; Zvelebil, 1980). Studies on pastoral nomads show that nomadic movement is understood in some cases as a ritual practice (Barth, 1961),

while other research focuses on seasonally structured and pasture-based spatial organization (Tapper, 1979) or documents the material techniques of nomadic camps (Diggard, 1981). This body of literature demonstrates that nomadic cultures are shaped not only by ecological factors but also by kinship relations, social hierarchies, and herd-management strategies, and that they differentiate accordingly (Bradburd, 1990; Salzman, 2004). Morphological analyses of nomad's tent clusters (Zamolyi, 2025), archaeological studies addressing regional and spatial variation in mobile pastoralism (Franchetti, 2012), and environmental-spatial research emphasizing responsiveness to ecological cycles and climatic variability (Amoruso and Conte, 2022; Mauvieux et al., 2014; Pfeifer, 2015) collectively show that pastoral nomadism is not merely a residue of the past, but a continuing condition across different cultures, hybrid and technologically entangled, that continues to shape modern life.

Among the communities that embody these principles, one nomadic community, the Yörüks of Anatolia, stands out as a compelling example. The term Yörük, derived from the Turkish verb yörü- (to walk or move), describes a way of life based on habitual movement, environmental sensitivity, and spatial adaptability (İnalcık, 2014). Historically, Yörüks developed a settlement logic based on ephemeral, modular, and repairable structures that supported cyclical mobility while ensuring responsiveness to shifting environmental conditions (Andrews, 1997; Bates, 1973; Beşirli and Erdal, 2008; Ersavaş and Özkanlı, 2018). Their settlement practices reflect a sophisticated entanglement with seasonal cycles, ecological variability, and more-than-human interdependence (Andrews, 1997; Bates, 1973; Doğan and Doğan, 2004; Ersavaş and Özkanlı, 2018; Lindner, 1983; Yeni, 2013).

The Yörüks were selected for this study because they are among the few pastoral nomadic communities in Anatolia that continue to maintain mobility-based traditions and settlement logics in ways that remain partially traceable within contemporary landscapes. This traceability offers a spatial archive through which the multiple determinants of pastoral mobility can be observed, interpreted, and systematically analyzed (Andrews, 1997; Bates, 1973; Pfeifer, 2015; Uçar and Gürer, 2025).

This study proposes to unveil Yörüks not as a relic of a vanishing past, but as a living model for alternative spatial imagination. Their spatial engagements are not merely utilitarian; they represent a culturally embedded design intelligence emerging from embodied negotiations with terrain, temporality, and social structure. To revisit Yörük

lifeways through a contemporary design lens is to unlearn the hegemony of standardized thinking and to reimagine architecture through the principles of mobility, temporality, and transformation.

2.2.2 Theoretical background

To uncover the spatial, cultural, and epistemological richness embedded in Yörük lifeways, it is essential to reposition spatial practices within contemporary theoretical discourses on design. This study is grounded in three intersecting theoretical axes: (1) nomadism and spatial theory, (2) utopian thinking and alternative life-worlds, and (3) phenomenology as it relates to tacit knowledge. Together, these frameworks form a cohesive lens through which to interpret the implicit design intelligence of nomadic culture and its relevance to contemporary architectural imaginaries.

2.2.2.1 Nomadism and spatial theory

Throughout history, nomadism has functioned not only as a mode of habitation but also as a philosophical and epistemological paradigm. Concept of *nomad thought* provides a critical departure from stabilized, hierarchical systems of knowledge, offering instead a fluid, anti-structural, and decentralized alternative (Deleuze and Guattari, 1987). Deleuze and Guattari (1987) defines distinction between *smooth space and striated space* that serves as a foundational theoretical schema for understanding the Yörük spatial ethos. While striated space is coded, segmented, and governed by order and repetition, smooth space is uncharted, continuously in formation, and resistant to formal boundaries. In this sense, the nomadic is not merely a spatial category but an epistemological stance, an anti-cartographic modality that resonates deeply with Yörük modes of inhabiting seasonal rhythms and transient geographies.

Yörük spatial practices exemplify this nomadic paradigm: their environments are not built upon fixed topographies but are instead dynamically reconstituted in alignment with ecological and temporal cycles. The Yörük tent, for instance, is not a permanent dwelling but a spatial event, a provisional construct that materializes at the intersection of motion, transformation, and temporality (Uçar and Gürer, 2025, 2026a, 2026b). As such, nomad thought is not confined to abstract theory; it finds tangible expression in the embodied, adaptive, and situational modalities of Yörük life.

This framework is further enriched by Lefebvre's theory of the social production of space, which posits that space is not a passive container but an active process, continuously constituted and reshaped (Lefebvre, 1991). This theory is particularly instructive in understanding nomadic life. Yörük spatial practices orchestrate temporary arrangements that attune to environmental affordances and communal rhythms. In Yörük lifeways, the act of making, the rhythm of everyday use, and the ecological logic of transition do not form hierarchical or sequential categories, but instead constitute an entangled, improvisational spatial practice. In nomadic culture, space is not a static product but a situated negotiation continuously authored through embodied improvisation.

2.2.2.2 Utopian thinking and alternative life-worlds

The spatial configurations of Yörük life are inseparable from the construction of alternative life-worlds. Here, the concept of utopia becomes central not as a distant or unreachable ideal, but as a critical tool for interrogating the present and imagining otherwise. As Jameson (2004, 2011) argues in his notion of the utopian impulse utopia functions as a political and cultural force capable of destabilizing normative structures and envisioning transformative futures. Similarly, Levitas (2013) defines utopia as the desire for a better way of being, a framework through which hope, critique, and imagination converge. In this light, Yörük culture emerges as a concrete manifestation of a utopian spatio-temporal configuration, an experimental ecology of living those challenges dominant paradigms of permanence, hierarchy, and anthropocentrism.

This alignment becomes even more pronounced when viewed through the lens of ecotopian thought, which emphasizes interdependent relationships with nature, locally embedded knowledge, and cyclical conceptions of time (Callenbach, 1975; Moylan, 1986; Sargisson, 2000). Yörük lifeways embody such an ethic: their seasonal migrations, symbiotic pastoralism, and calibrated use of resources reflect a sustainable ethos predicated not on domination but on mutual adaptation. Their relation to the environment is not extractive but transformational favoring attunement over intervention. This resonates with Illich's (1973) concept of *vernacular domain*, in which localized, pre-industrial forms of knowledge are not seen as obsolete residues but as critical survival strategies in the face of systemic collapse. The Yörük spatial

ethos, then, is not merely a tradition to be preserved but a speculative template for post-anthropocentric, resilient design futures.

2.2.2.3 Phenomenology and tacit knowledge

Rooted in Husserl's (1970) project of epoché the natural attitude, phenomenology seeks to apprehend phenomena as they present themselves, suspending inherited assumptions. This makes it especially apt for investigating nomadic spatio-temporalities. Merleau-Ponty's emphasis on the embodied subject as the origin of spatial meaning further enriches this lens: in nomadic culture, the body is not merely located in space it co-produces it (Merleau-Ponty, 2013). Similarly, Heidegger's (1971) conception of dwelling as an existential mode of spatial engagement, and Ingold's (2000) dwelling perspective, reorient our understanding of space from an object to be designed to a world to be inhabited through movement, memory, and interaction.

Within this constellation of thought, tacit knowledge becomes a pivotal analytic tool. *Tacit knowledge* refers to forms of knowledge that are not easily verbalized, yet are deeply embedded in practice, intuition, and bodily engagement (Polanyi, 2009). In the context of design, tacit knowledge becomes most visible in moments of decision-making, such as site selection, orientation, settling, material improvisation, and environmental adaptation. Tacit knowledge, then, is not simply a matter of individual craftsmanship, it is a form of collective memory, cultural transmission, and everyday design cognition (Collins, 2012; Schön, 1984). Yörük spatial practices are steeped in such knowledge, transmitted not through written manuals but through generational experience, embodied repetition, and lived coninuity.

Taken together, these theoretical perspectives position the Yörük way of life as a legitimate site for utopian rethinking in the context of contemporary design. The utopia invoked here does not reside in an unattainable ideal, but in lived, tested, and sustainable modes of existence that privilege adaptability, communal making, and ecological attunement over private property and hierarchical fixity (Bloch, 1995). Yörük lifeways exemplify what might be called a "*pragmatic utopia"* (Jameson, 2004, 2011; Levitas, 2013) a vision grounded in practice, resilience, and generational wisdom. These theoretical perspectives invite us to rethink design as a situated praxis informed by motion, transformation, and temporality. As such, it offers a critical

ground for exploring the possibilities of engaging *utopia as a method* (Jameson, 2011; Levitas, 2013).

2.2.3 Method

To uncover the architectural intelligence embedded within Yörük culture, the study adopts a phenomenological approach that centers on direct experience and seeks to access the internal logics of spatial and temporal formation from within. Phenomenology, with its focus on the lived experience, offers a lens through which nomadic practices and their spatial articulations can be examined beyond static or object-centered interpretations. By employing notion of epoché (Husserl, 1970), the research suspends normative assumptions associated with sedentary architectural modernity and seeks to understand Yörük spatial practices on their own terms. This allows tacit knowledge to be approached not as informal or pre-modern, but as a legitimate and generative mode of spatial reasoning. Within this perspective, Yörük space is understood not as static but as perpetually reconstituted, a spatiality defined by becoming rather than being.

The study draws particularly from Husserl's foundational articulation of phenomenology, invites the researcher to suspend presuppositions in order to perceive phenomena as they appear (Husserl, 1970). Through this strategy, normative assumptions about permanent architecture or sedentary life are held in abeyance, enabling the emergence of the nomadic living. In this framework, nomadism is not approached through the logic of stasis or built form, but through a logic of transition, recurrence, and continuous spatial reinvention. Rather than seeking objective results, the research emphasizes becoming, the evolving conditions and logics by which space is co-constructed in motion.

A second rationale for the phenomenological orientation lies in the embodied nature of nomadic life. Drawing on phenomenological theory of the lived body, which understands perception as grounded in bodily interaction with the world, the study conceptualizes the nomadic body as a spatial agent (Merlau-Ponty, 2013). The Yörüks does not merely occupy space; it senses, interprets, and actively configures it. As the body is the first instrument of perception; for the Yörüks, it is also the medium through which spatial choices are negotiated and enacted in relation to terrain, climate, and memory. The body thus becomes a site of cognition, a producer of knowledge

responsive to ecological signals, collective histories, and affective cues. This triangulation of body, mind, and environment forms the analytical core of the study.

Building on this understanding of the body as a spatial agent, this study examines Yörük spatial practices through four phenomenological phenomena: cell, provision, transition, and nomad. The analysis is conducted through the transformation of photographic images recorded during fieldwork into sketches. The visual material presented in this study is derived from the author's direct field observations conducted during a series of short-term visits to independently established Yörük camps between 2023 and 2025. These visits involved on-site observation, photographic documentation, and informal conversations with Yörük families, with particular attention to moments of camp establishment and dismantling. While the research does not employ long-term participant observation, this approach enables the identification of recurring spatial and bodily patterns across different contexts.

For this reason, the transformation of photographs into sketches constitutes an analytic and interpretive process. The shift from photograph to sketch functions as a key methodological operation through which embodied spatial knowledge is translated into a conceptual register.

The aim of the study is to articulate the temporality and relational logic of ephemeral spatial production through a phenomenological mode of inquiry. The sketches do not depict fixed spatial forms; instead, they operate as conceptual tools that capture moments of dwelling, disassembly, reorientation, and movement. Through this process, space is approached as a condition continually reconstituted through everyday practices, bodily actions, and environmental cues.

The sketches are not treated as isolated visual artifacts but are read collectively as a visual matrix. This matrix provides a narrative ground through which the phenomena of cell, provision, transition, and nomad can be examined relationally. Patterns of continuity, repetition, and variation across the sketches enable an analytic reading of the temporal and embodied logic of Yörük spatiality. In this sense, the visual materials function as phenomenological instruments through which spatial knowledge is produced, interpreted, and discussed.

Ultimately, this approach seeks to reveal the spatio-temporal logic of nomadic life as a mode of being in continual negotiation with terrain, seasonality, and impermanence.

The ephemeral dwelling is a phenomenon whose essence is enacted through re-settlement. Nomadism, in this sense, emerges as a form of dwelling in motion. Through this lens, the study becomes a meditation on the possibilities and conditions of temporary architecture, examining how its impermanence fosters ecological sensitivity, social adaptability, and a rethinking of spatial agency. The phenomenological bracketing employed here does not aim to objectify the nomadic condition, but to distill its experiential essence and bring it into dialogue with contemporary design thought.

2.3 Analysis: Revealing a Living Utopia

This section presents the phenomenological findings of the study by weaving together sketches derived from photographic material recorded during field research and read collectively as a visual matrix. The spatial ethos of Yörük culture is examined through four interrelated phenomena: cell, provision, transition, and nomad. The investigation unfolds across a multilayered analytical path composed of sketches capturing specific moments from Yörük daily life and matrices that frame and differentiate nomadic practices through the lens of the selected phenomena. This inquiry operates through phenomenological tools, engaging sketches and narrative to foreground the analytic and interpretive potency of the line.

To clarify the reading of the visual material, the analysis employs a systematic coding notation that extends phenomenological bracketing. Square brackets mark moments of analytic suspension in which visual material is isolated for focused analysis. Within this notation, the first letter indicates the analytical phenomenon under examination (C for Cell, P for Provision, T for Transition, and N for Nomad), followed by the matrix number corresponding to the relevant figure and a lowercase letter identifying a specific focal moment within that matrix. For instance, [C-m1(a)] refers to a particular visual focus in matrix 1 read through the phenomenon of the cell.

These coded references function as epistemic markers that connect visual observations to conceptual arguments. In doing so, the sketches operate as analytical instruments through which embodied, spatial, and temporal knowledge is bracketed, interpreted, and reintroduced into the narrative flow of the analysis, enabling experiential observations to be translated into a structured interpretative framework without losing their contextual grounding.

2.3.1 Cell

Cell refers to the core unit of dwelling in nomadic life, typically the tent occupied by a family. Unlike static architecture, the nomadic cell is portable, ephemeral, and environmentally sensitive. It delineates a provisional boundary between inside and outside, organizing spatial belonging not as permanence but as momentary enclosure. It is simultaneously a physical and symbolic, a site of bodily orientation, affective security, and ecological embeddedness.

This processual understanding of the cell becomes particularly visible in Figure 2.1 [C-m1(a–e)], which documents the incremental formation of the tent through a sequence of construction gestures. The unfolding of textiles, anchoring of stakes, and erection of poles do not follow a predetermined blueprint. Instead, spatial form materializes through bodily judgment and situational responsiveness. The placement of stakes [C-m1(a)] inscribes orientation and balance into the ground, while the unfolding of fabric [C-m1(b)] initiates a sensory demarcation of place. Through direct bodily contact with terrain, slope, texture, and wind direction are read without recourse to abstract measurement. These gestures reveal how the cell is constituted as a lived negotiation between body, material, and environment rather than as a designed object imposed upon the landscape.

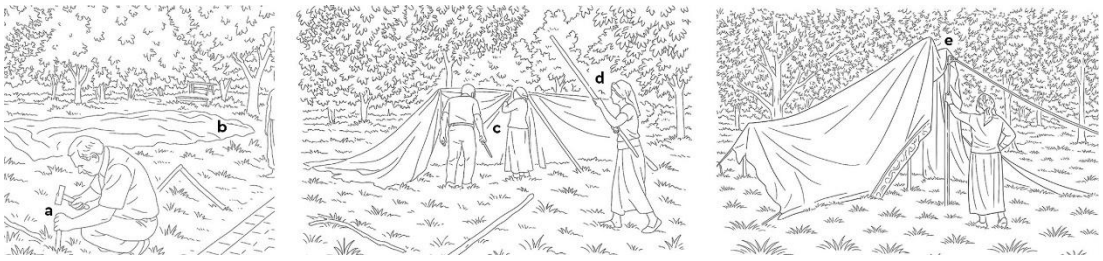

Figure 2.1: Phenomenon 1 (Cell), Matrix 1 (Source: Uçar and Gürer, 2026b).

The collective dimension of nomadic construction is likewise integral to the formation of the cell. The coordinated lifting and stretching of textiles [C-m1(c–d)] demonstrate how spatial form emerges through shared bodily rhythm. Here, the dwelling is not first designed and then assembled. It comes into being through co-performed gestures that embed sociality directly into its structure. The cell is therefore inseparable from the collective choreography that produces it, foregrounding making as a relational and temporal act.

The provisional stability of the cell is further articulated in Figure 2.2 [C-m2(f–i)], which focuses on the stretching, tying, and knotting of ropes. These actions stabilize the tent while preserving its capacity for disassembly and reconfiguration. Tension is calibrated through bodily sensing, as tautness is tested, airflow is read, and adjustments are made in response to shifting environmental conditions [C-m2(f–g)]. The act of knotting [C-m2(h)] embodies a critical paradox of nomadic dwelling. It secures the structure without foreclosing the possibility of reversal. Stability, in this context, is not achieved through permanence but through practices that remain open to change. Design is not imposed as a final solution but continuously performed and renegotiated.

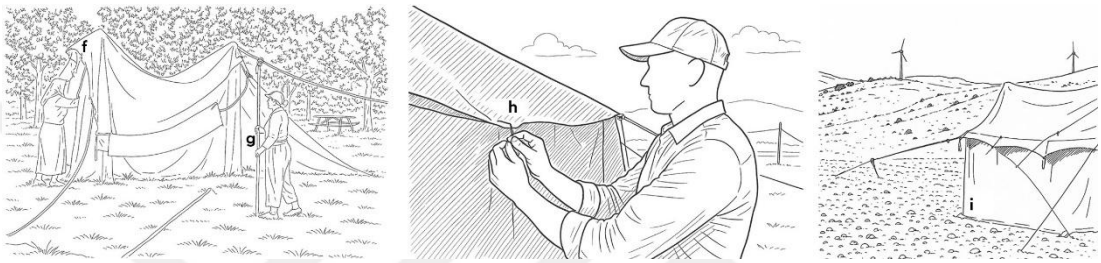

Figure 2.2: Phenomenon 1 (Cell), Matrix 2 (Source: Uçar and Gürer, 2026b).

While Figures 2.1 and 2.2 foreground the emergence of the cell through constructional gestures, Figure 2.3 [C-m3(a–i)] shifts attention inward and reveals how the tent's components structure everyday inhabitation. Taken together, the central pole, layered textiles, tension ropes, and fringes articulate an interior that is not rigidly zoned but dynamically modulated through use. These elements function less as architectural details than as tactile and atmospheric mediators. They shape patterns of proximity, gathering, rest, and privacy. The central pole anchors not only the structure but also the rhythm of daily life [C-m3(c–d)], while textiles and cushions soften the threshold between body and ground and embed memory and routine into the spatial core of the cell [C-m3(e)]. In this sense, the interior of the nomadic cell is not a fixed layout but a lived space that is continually adjusted through bodily presence and movement.

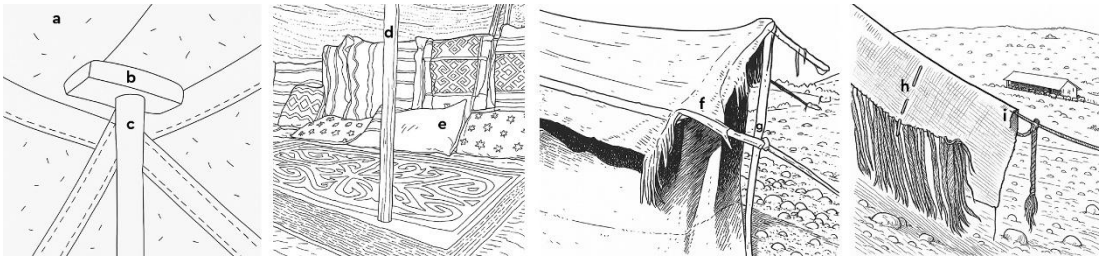

Figure 2.3: Phenomenon 1 (Cell), Matrix 3 (Source: Uçar and Gürer, 2026b).

The concept of the cell extends beyond the human dwelling itself, as demonstrated in Figure 2.4 [C-m4(a–c)], which presents variations of the cell across different scales and relations. Goat enclosures [C-m4(a)], shade structures [C-m4(b)], and the shepherd's cloak, known as the kepenek [C-m4(c)], function as alternative manifestations of the cell within Yörük lifeways. These examples reveal that the cell is not a human-exclusive or typologically fixed unit. Instead, it operates as a relational spatial logic that supports life through temporary and responsive arrangements. Whether sheltering animals, bodies, or both, these structures prioritize modulation over enclosure and rhythm over permanence. The kepenek, in particular, collapses the distinction between architecture and clothing. It operates as a wearable cell, a mobile micro-habitat that moves with the body and adapts continuously to terrain and climate.

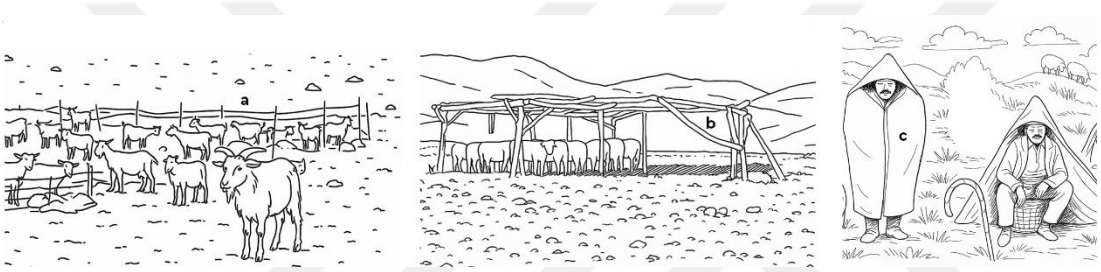

Figure 2.4: Phenomenon 1 (Cell), Matrix 4 (Source: Uçar and Gürer, 2026b).

Taken as a whole, the cell emerges not as a singular architectural form but as a mode of dwelling enacted through embodied practice. It is a spatial condition that is continuously produced through acts of settling, adjusting, and recalibrating in relation to environmental forces and collective rhythms. The nomadic cell thus exemplifies a form of dwelling grounded in temporality, reversibility, and ecological sensitivity. It constitutes a foundational phenomenon through which nomadic spatial intelligence becomes legible.

2.3.2 Provision

Provision encompasses the Yörüks' strategies for sustenance and survival, including pastoralism, access to water sources, and environmentally attuned movement patterns. These are not merely economic practices; they function as spatial drivers, determining migration routes, settlement durations, and landscape interactions. Provision serves as the motivational force behind spatial configuration-shaping where and how the cell is deployed.

This relational logic becomes visible in Figure 2.5 [P-m5(a–c)], which situates nomadic dwelling within an extended ecological field. The positioning of herds and human bodies is shown to be inseparable from access to water, shade, pasture, and atmospheric conditions. These matrices reveal that nomadic space-making is never isolated from its ecological context. It is composed through alignments, proximities, and environmental feedbacks that continually attune spatial decisions. The tent, in this framework, functions less as a discrete structure and more as a permeable membrane that mediates light, air, and weather in direct relation to survival needs.

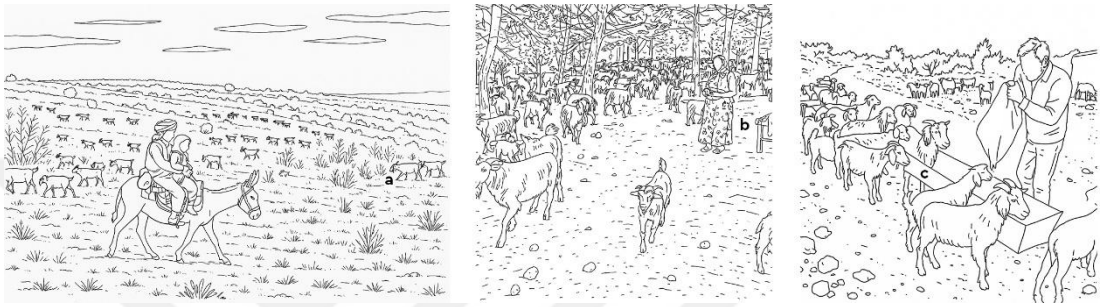

Figure 2.5: Phenomenon 2 (Provision), Matrix 5 (Source: Uçar and Gürer, 2026b).

The expansive grazing landscape depicted in [P-m5(a)] illustrates provision as an ecological negotiation rather than an act of extraction. Sustenance is not imposed upon the land but followed through movement, guided by seasonal rhythms and inherited spatial memory. The paths traced by herds and nomads do not correspond to abstract grids or fixed routes. Instead, they form a living archive of remembered passages shaped by availability, climate, and terrain. Provision here unfolds as a distributed ecology of motion in which humans and animals co-inhabit cycles of subsistence.

Moments of pause within this broader movement further clarify the spatial logic of provision. The shaded gathering of goats beneath trees in [P-m5(b)] marks a temporary reconfiguration of space oriented toward rest, hydration, and coordination. This is not a permanent settlement but a temporal adjustment that responds to heat, fatigue, and bodily need. The nomad occupies a mediating position within this configuration, guiding the herd through proximity and presence rather than command. Provision in this instance circulates atmospherically through shade, humidity, gesture, and shared stillness. Space assembles momentarily through care, then disperses as conditions change.

Provision also manifests at smaller spatial scales through acts of concentrated coordination. The feeding scene in [P-m5(c)] demonstrates how nourishment produces

a temporary spatial order. The movement of animals toward the trough, their patterned gathering, and their familiarity with the routine reveal a distributed intelligence shaped by repetition and mutual attunement. The feeding box itself is not a fixed installation but a mobile infrastructure, repositioned according to cycles of hunger, rest, and terrain. Provision here operates as a relational act that requires knowing when, where, and how to intervene rather than imposing a stable spatial arrangement.

Taken together, these scenes reveal provision as a dynamic system that precedes and shapes spatial form. Nomadic space is not planned independently of sustenance. It is continually reorganized in response to ecological availability, bodily rhythms, and collective movement. Through provision, space becomes adaptive, responsive, and temporary, calibrated to survival rather than permanence. As such, provision constitutes a second foundational phenomenon of nomadic spatial intelligence, demonstrating how life-sustaining practices actively configure the spatial conditions of dwelling.

2.3.3 Transition

Transition captures the temporality of nomadic life. It is the condition of perpetual movement between states, departure and arrival, seasons and landscapes. Time is not experienced as linear but as cyclical and rhythmic. This cyclicality structures not only mobility but also rituals of learning, adaptation, and reconstruction, wherein knowledge is continually reactivated in response to shifting contexts.

This temporal logic becomes visible in Figure 2.6 and Figure 2.7 [T-m6,7(a–e)], which traces a sequence of moments that together articulate transition as a rhythmic process rather than a discrete event. The gathered herd shown in [T-m6(a)] occupies a state of suspension prior to movement. This moment is defined not by motion itself but by its imminence. Bodies assemble, attention sharpens, and readiness accumulates. The shepherds are positioned within the herd rather than above it, indicating that transition begins through shared anticipation and collective attunement rather than command.

Movement unfolds gradually through traces inscribed in the landscape. The winding path visible in [T-m6(b)] is not imposed upon the terrain but formed through repeated passage. It operates as a spatial memory rather than a static route. In nomadic life, transition does not proceed from one point to another along an efficient line. Instead, it follows patterns shaped by habit, availability, and environmental care. The path

bends in response to shade, safety, and sustenance, revealing space as a lived archive of accumulated transitions.

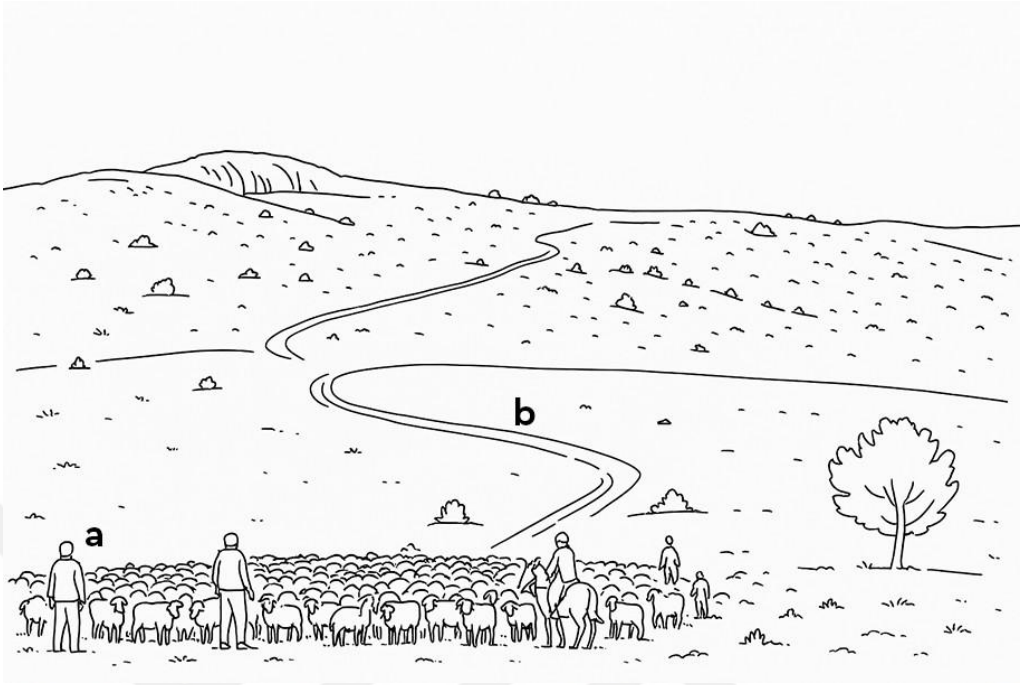

Figure 2.6: Phenomenon 3 (Transition), Matrix 6 (Source: Uçar and Gürer, 2026b).

As movement continues, transition becomes a process of ecological negotiation. The passage of the herd through wooded terrain in [T-m7(c)] demonstrates how mobility adapts to density, vegetation, and narrowing spatial thresholds. Bodies slow, cluster, and disperse in response to environmental conditions. Movement here is neither uniform nor continuous. It pulses and modulates according to terrain, temperature, and instinct. The wooded passage functions as a spatial hinge where landscape and lifeworld mutually recalibrate.

Moments of orientation further define the temporal structure of transition. The shepherds pausing to scan the terrain in [T-m7(d)] enact a form of embodied navigation. These gestures do not represent detached observation but situated interpretation. Signals of slope, cloud movement, and herd behavior are read intuitively through accumulated experience. Transition, in this sense, is not reactive. It is anticipatory and interpretive, grounded in an ongoing dialogue between body, memory, and environment.

Periods of rest complete the cycle of movement. The fenced resting space beneath trees in [T-m7(e)] marks a temporary reconfiguration of space oriented toward recovery rather than arrival. This pause does not signal the end of movement but its continuation

under altered conditions. Shade, enclosure, and stillness form a microclimate that allows bodies to recalibrate and social relations to renew themselves. In nomadic temporality, such pauses are not interruptions of progress. They are integral rhythms of survival that enable movement to persist.

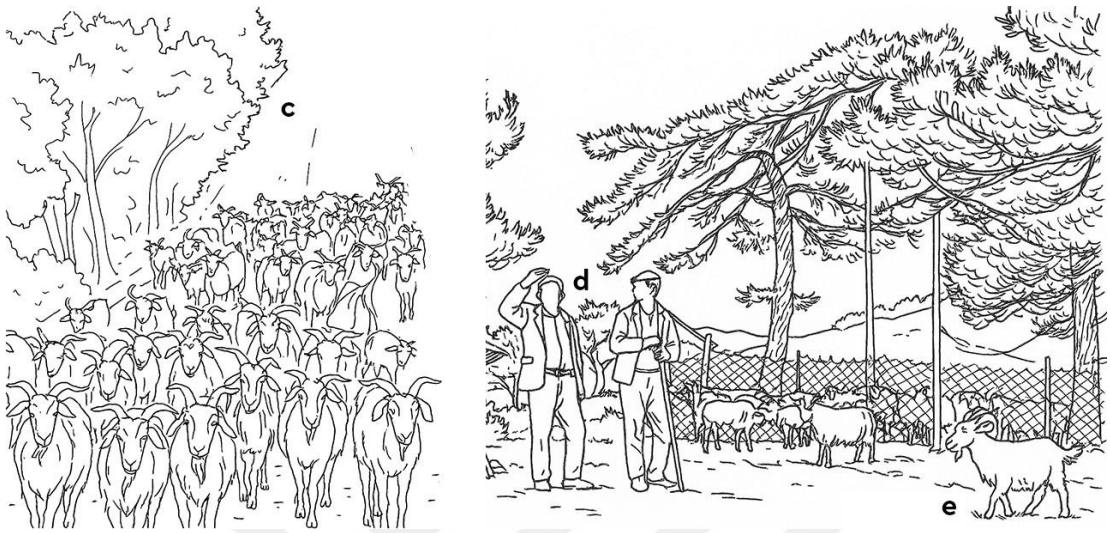

Figure 2.7: Phenomenon 3 (Transition), Matrix 7 (Source: Uçar and Gürer, 2026b).

Taken together, these sketches do not document isolated spatial arrangements. They articulate transition as an ongoing temporal condition through which place, knowledge, and behavior are continuously reconfigured. Transition emerges here as cyclical rather than linear, operating through repetition, pause, and reorientation. As the third analytical phenomenon of the study, transition reveals how nomadic dwelling is sustained through temporal intelligence, demonstrating that space is continually produced not only through movement, but through the rhythms that give movement duration and meaning.

2.3.4 Nomad

Nomad represents the subject of this life-world, a figure who is neither sedentary nor randomly mobile, but one who reads environmental cues, remembers past experiences, and reconstitutes space through every gesture of movement. The nomad is not only a dweller but a cartographer of the ephemeral, constantly recalibrating spatial relations in response to ecology, memory, and social need.

This body-centered learning process becomes visible in Figure 2.8 and Figure 2.9 [N-m8,9(a–e)], which documents recurring everyday actions through which spatial intelligence is accumulated and activated. These sketches demonstrate how knowledge

is embedded in posture, rhythm, and material interaction rather than in explicit rules. Through repetition, the body stores spatial intelligence and reactivates it in response to changing environmental conditions. The nomad thus emerges as a sensor, a doer, and a knower, someone who reads terrain through motion and configures space through embodied practice.

The act of milking a goat in [N-m8(a)] exemplifies this intimate transmission of knowledge. What appears as an agricultural task unfolds as a calibrated choreography between human and animal. The positioning of the body, the placement of the pail, and the stillness of the animal are not governed by instruction but by learned attunement. Knowledge here resides in gesture and muscle memory, refined through repetition. Learning occurs through touch and timing, through listening with the hands. Production and care converge as inseparable practices enacted in motion.

Processes of making further reveal how nomadic knowledge is sustained through rhythm rather than efficiency. The spinning wheel depicted in [N-m8(b)] operates as a medium of memory rather than a tool optimized for speed. As fibers twist into thread, balance is achieved through sensing rather than calculation. Excessive speed breaks the thread, while insufficient tension causes failure. This calibration is embodied, not instructed. The spinner becomes part of the mechanism, participating as a co-constitutor rather than a detached operator. Nomadism here is expressed not through geographic displacement but through the continuous transformation of environment into form.

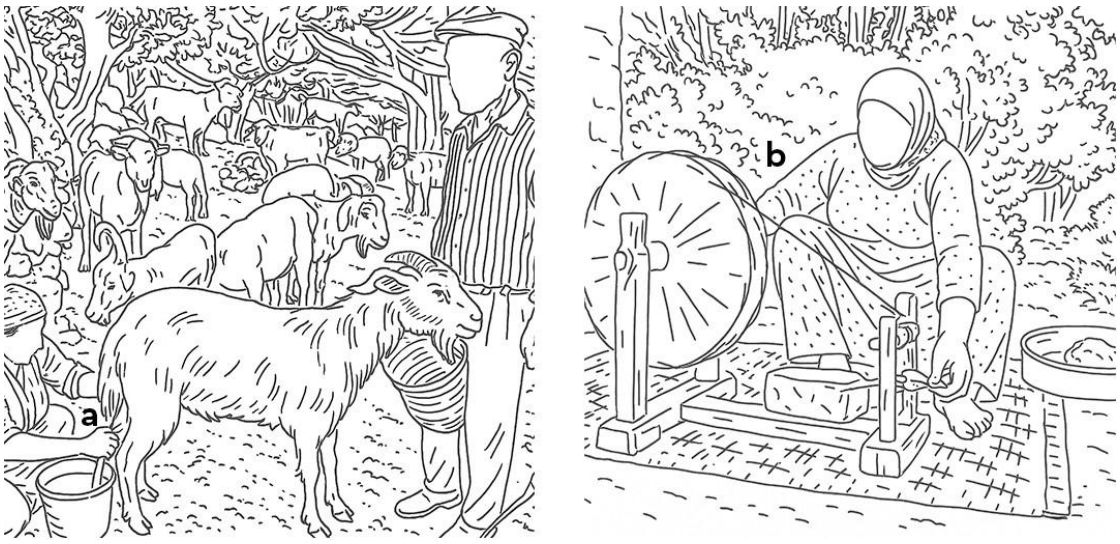

Figure 2.8: Phenomenon 4 (Nomad), Matrix 8 (Source: Uçar and Gürer, 2026b).

Weaving practices extend this embodied intelligence into spatial patterning. In [N-m9(c)], the seated weaver performs a form of cartography through tactility. Each movement encodes rhythm, density, and direction, remembered not as abstract patterns but as sequences of action. The loom functions as a matrix of place where material arrangement and lived relation intersect. Nomadic design, in this context, is not external to life or imposed upon it. It is immanent within everyday practice and sustained through bodily memory.

Temporal sensitivity is further articulated through acts of material transformation. Stirring the dye pot in [N-m9(d)] demonstrates how time is sensed rather than measured. Color emerges gradually through heat, waiting, and attention to shade, scent, and viscosity. This process does not follow standardized procedures but relies on embodied sensing transmitted across generations. The nomad appears here as a synthesizer of elements, composing material outcomes that carry ecological memory and cultural meaning.

The drying wool skeins shown in [N-m9(e)] render time visible in space. Hung to dry, the fibers become markers of process rather than endpoints. They retain the traces of every gesture that shaped them, transforming the wall into an archive of labor and duration. In this configuration, the nomad is not defined solely by movement across the landscape. Rather, the nomad curates processes, threading body, material, and environment into a coherent yet temporary spatial rhythm.

Figure 2.9: Phenomenon 4 (Nomad), Matrix 9 (Source: Uçar and Gürer, 2026b).

Across all these reveals, a consistent theme emerges: that nomadic space is not designed in the conventional sense of the term. It is enacted, moment by moment, in

rhythm with the land, the weather, and the cycles of life. Design here is emerging from lived interaction, responsive to change, and open to improvisation. This spatial ethos also carries profound utopian implications. Yörük lifeways enact an alternative model of inhabiting the world that resists fixation, refuses enclosure, and prioritizes adaptability, autonomy, and ecological coherence. The shelters are not monuments; they are resilient, responsive, and beautiful in their temporarity.

In this sense, Yörük nomadism constitutes a living utopia, a world-in-motion that offers critical insights for rethinking architectural temporality, environmental sensitivity, and spatial agency in an era of ecological volatility. What is at stake is not merely an ethnographic curiosity but a radical proposal: that design can be rhythmic rather than rigid, bodily rather than blueprint-based, and ecologically attuned rather than territorially stabilized. Through this integrated approach the study does not merely describe nomadic space. It performs this by unfolding a matrix of rhythm, intuition, and temporality that can inform contemporary design imaginaries far beyond the bounds of its cultural origin.

2.4 Conclusion: Nomadism as a Design Utopia

This study has explored Yörük lifeways through a phenomenological and conceptual lens, demonstrating that nomadism is not merely a remnant of the past but a living design paradigm that offers generative possibilities for the future of spatial thinking. Yörük nomadism unfolds as a system of mobility-based, ecologically attuned, and body-centered spatial production. It draws on tacit forms of knowledge that resist codification yet carry profound architectural intelligence. In contrast to dominant planning frameworks that rely on permanence, linear time, and abstract control, the nomadic mode emerges as a flexible, responsive, and rhythmic practice of world-making.

This re-framing carries critical implications for how we might envision space in the face of escalating ecological, spatial, and social crises. The findings of this study point toward three key contributions: the re-reading of nomadic cultures as a living utopia, conceptual insights for contemporary design and planning, and opportunities for broader comparative and interdisciplinary research.

Nomadic cultures have long been marginalized within the narrative of modernity, dismissed as rural, peripheral, or obsolete. Yet this research repositions it as a powerful example of alternative spatial organization. The cyclical rhythms of movement, the ecological sensibility of settlement, and the embodied transmission of knowledge constitute a mode of resilience that resonates deeply with the urgencies of the present. Yörüks construct a continuously renewed world, one built not through permanence but through environmental reciprocity, temporal repetition, and social adaptability. Their knowledge systems, maintained through oral culture, intergenerational practice, and embodied memory, provide a model for spatial and cultural sustainability.

From this perspective, nomadic life must not be seen as a static tradition but as a conceptual resource, a generative ground for reimagining architecture, planning, and design methodologies. In an era marked by accelerated urbanization, environmental collapse, and social fragmentation, the practices of mobile life offer a critical lens through which to rethink spatial production. Nomadism proposes a processual, situated, and ecological approach to design that values rhythm over repetition, movement over enclosure, and responsiveness over standardization.

From the perspective of utopian thinking, this study proposes nomadism not as a nostalgic remnant of pre-modern life but as a speculative yet grounded framework for reimagining spatial agency, environmental reciprocity, and cultural sustainability. Through the articulation of four interrelated phenomena-cell, provision, transition, and nomad-the research demonstrates how Yörük lifeways offer a nuanced and embodied model of inhabitation that resists the rigid dichotomies of permanence and mobility, center and periphery, tradition and progress. What emerges is not a blueprint for ideal living, but a matrix of practices that can inform alternative futures of design. In this light, nomadism functions as a critical method for interrogating the spatial logics of modernity and envisioning design as a temporal, performative, and ecological process.

This reframing allows us to consider Yörük nomadism as a situated, embodied mode of utopian dwelling that evolves in rhythm with ecology and temporality. Unlike classical utopias that rely on static ideals and totalizing visions, this form of utopia is processual, experiential, and deeply entangled with material realities. It is fragile yet resilient, vulnerable yet generative. In an era of ecological uncertainty, social fragmentation, and design standardization, the Yörük model offers not only a critique of the dominant spatial paradigms but also a tangible alternative that affirms the

possibility of designing otherwise. To dwell, in this sense, is not to fix space, but to enter into rhythm with it, to practice design as a mode of attunement, care, and adaptation. This is the political and poetic force of nomadism as a design utopia.

In conclusion, this study argues for a reorientation of design theory, away from static, object-based paradigms and toward mobility-centered, experiential, and tacitly informed models of spatial production. Through the lens of Yörük culture, nomadism emerges as not only a historical phenomenon but a design utopia: a lived, tested, and sustainable alternative to the dominant imaginaries of architectural modernity. This is not a utopia in the classical sense of perfection or inaccessibility. Rather, it is an everyday utopia, fragile, provisional, and continuously enacted. It offers a radical proposition: that to dwell otherwise, to design otherwise, is not only necessary but already possible.

3. A HERITAGE ECOSYSTEM IN MOTION: YÖRÜK SPATIAL PRACTICES AND THE ECOLOGY OF MOBILITY[2]

3.1 Introduction

The evolving discourse on cultural heritage increasingly highlights its connections to ecological systems and everyday life. Rather than being conceived as static remnants of the past, heritage is now understood as a dynamic and relational phenomenon shaped through ongoing interactions among people, materials, landscapes, and non-human agents (DeSilvey, 2017; Harrison, 2015; Holtorf and Fairclough, 2013). This perspective reflects a broader shift from object-centered preservation to process-based heritage management, redefining heritage as an active actor that supports sustainability, identity, and resilience (DeSilvey, 2012). In this study, cultural heritage is conceptualized as a situated designation shaped through spatial practices.

Reconceptualizing heritage through ecosystemic and mobility-centered perspectives aligns with current debates in environmental humanities, posthuman geography, and ecological anthropology (Harrison, 2015). These approaches foreground the environmental and more-than-human forces that shape heritage processes. The Gunma Prefecture (ICOMOS, 2025) explicitly supports this more-than-human perspective by acknowledging both human and non-human actors as stakeholders in the valuation, management, and transmission of heritage ecosystems.

This ecological perspective offers new ways to engage with nomadic and pastoralist communities whose lifeways are closely aligned with environmental rhythms, animal needs, and seasonal mobility cycles (Krätli, 2015; Nori, 2019). Their settlements are built not on permanence but on seasonal changes and livestock welfare, emphasizing

[2] This chapter is based on the article: Uçar U.E., Gürer E., A Heritage Ecosystem In Motion: Yörük Spatial Practices And The Ecology Of Mobility, published [2026], [© 2026 Journal of Cultural Heritage Management and Sustainable Development]
https://doi.org/10.1108/JCHMSD-05-2025-0116

adaptability. These communities challenge sedentary assumptions of conventional heritage paradigms, showing that mobility can function as a meaningful epistemological and ecological strategy (Rose, 2011; Viveiros de Castro, 2004).

Gilbert (2014) outlines multiple forms of nomadism within mobile cultures, highlighting pastoral nomadism as a distinct category. Defined by mobility centered on the care and management of livestock, pastoral nomadism reflects a way of life in which movement patterns are shaped by ecological rhythms and animal welfare (Barfield, 2012; Barnard and Wendrich, 2008; Zvelebil, 1980). Research on pastoral nomads shows how their mobility patterns, camp formations, and seasonal movements demonstrate complex spatial and social logics. Some studies frame nomadic movement as ritual practice (Barth, 1961), others examine seasonally structured and pasture-based spatial organization (Tapper, 1979), while additional work documents the material techniques of nomadic camps (Digard, 1981). These studies reveal that migration routes, camp layouts, and seasonal timing are shaped not only by ecological factors but also by kinship obligations, hierarchical social relations, and herd-management strategies (Bradburd, 1990; Salzman, 2004). Morphological analyses of tent clusters (Zamolyi, 2025), archaeological research on regional and spatial variation in mobile pastoralism (Frachetti, 2012), and environmental-spatial studies emphasizing responsiveness to ecological cycles and climate variation (Amoruso & Conte, 2022; Mauvieux et al., 2014; Pfeifer, 2015) collectively show the ecological, cultural, and spatial multi-determinacy of pastoral nomadism.

Among the communities that embody these principles, the Yörüks of Anatolia stand out as a compelling example. Their settlement practices reflect a sophisticated entanglement with seasonal cycles, ecological variability, and multispecies interdependence (Andrews, 1997; Bates, 1973; Doğan and Doğan, 2004; Ersavaş and Özkanlı, 2018; Lindner, 1983; Yeni, 2013). The Yörüks were selected for this study because they are among the few pastoral nomadic groups in Anatolia who continue to maintain mobility-based traditions and settlement logics in ways that remain partially traceable in contemporary landscapes. This traceability provides a spatial archive through which the multiple determinants of pastoral mobility can still be observed, interpreted, and systematically analyzed (Bates, 1973; Andrews, 1999; Pfeifer, 2015; Uçar and Gürer, 2025).

As pastoral nomads, Yörüks follow defined seasonal patterns shaped by livestock needs and environmental rhythms. Their transhumant lifeways, characterized by cyclical migrations between summer highlands (yaylak) and winter lowlands (kışlak), make it possible to observe settlement practices across clearly distinguishable phases of the seasonal cycle. To understand these phases, this study focuses on the spatial patterns of Yörük mobility. Together, these patterns form an ordered sequence that reveals the temporal structure of pastoral nomadism.

Drawing on studies that conceptualize space as a sequential arrangement of distinct yet interrelated events (Tschumi, 1994, 1996) and on visual methods that use diagrammatic juxtaposition to reveal the relational dynamics of movement (Buck and Molinari, 2022; Eisenstein, 1943, 2010), Figure 3.1 presents mobility as a temporally layered structure. The diagrammatic technique shows that mobility emerges from the cumulative effect of adjacency, overlap, and rhythmic ordering of actions. Within this framework, mobility is understood as a series of spatial events whose relational sequencing reveals the spatial logic underlying nomadic lifeways.

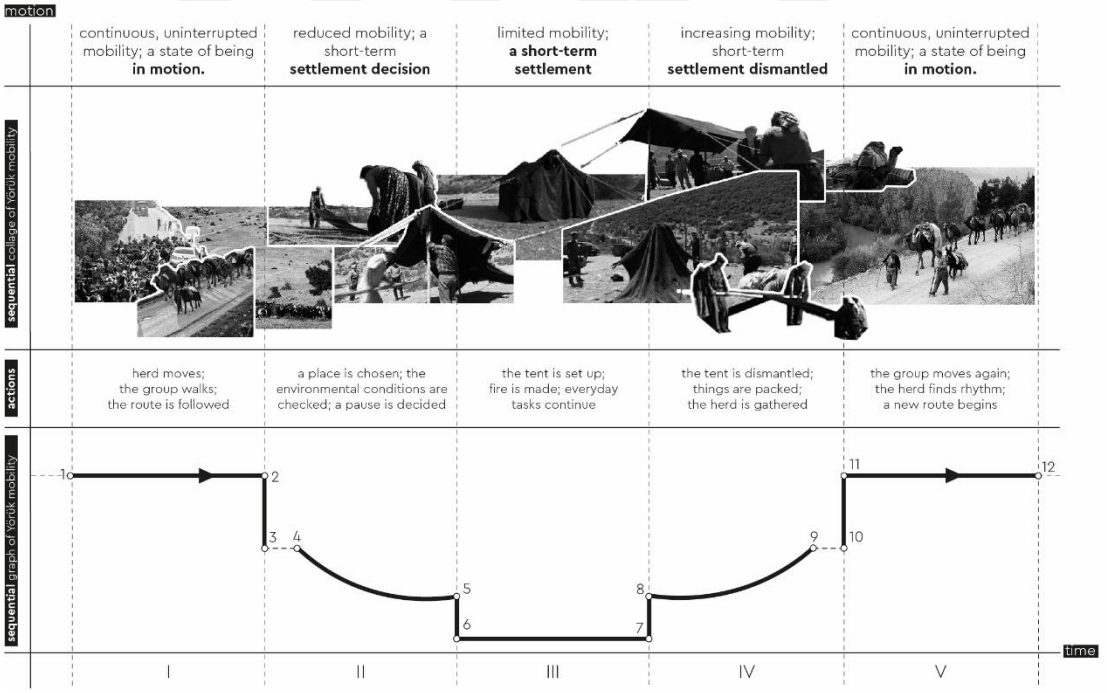

Figure 3.1: Sequential diagram of Yörük mobility (Source: Uçar and Gürer, 2026a).

In this regard, mobility can be understood as a fundamental element of both social and spatial thought (Schwartz-Clauss et al., 2002; Merriman, 2012). Accordingly, mobility is related to ecological processes that shape how heritage is produced, negotiated, and transmitted. Building on this conceptual foundation, the study focuses on the

following research question: “How have Yörük tent groups been organized spatially, and what patterned logics, adaptive strategies and environmental reasoning underlie their arrangement within nomadic settlement practices?”.

Answering this question requires a methodological framework capable of capturing spatial configurations across different temporal and environmental conditions. For this reason, the study adopts a visual-analytical approach supported by a diverse dataset. This framework enables the identification of recurring spatial principles in Yörük camps, which are later formalized into a visual grammar.

3.2 Methodology

3.2.1 Framework

This study uses a multilayered methodological framework to make the collectively inherited and tacit spatial knowledge embedded in Yörük settlement practices both visible and reusable (Figure 3.2). The primary data for this research was obtained from a hybrid visual dataset composed of field observations, historical photographic collections and ethnographic sources. This dataset was evaluated through both environmental and spatial lenses within a conceptual background that considers not only the static arrangements of settlements but also their formation processes in motion. Further details on this dataset are provided in Section 2.2.

The analysis process is grounded in the construction of a visual, rule-based system that forms the core methodological approach of the study. The hybrid visual materials were first transformed into a standardized set of diagrams to ensure comparability. These diagrams were then used to identify recurring spatial patterns across multiple spatial layers. This visual analysis made the mobility-based modes of spatial production more legible, revealed the repeated decision-making logics and enabled these patterns to be translated into systematic spatial rules. Methodological details related to this stage are provided in sections 3 and 4.

In the final stage, the extracted rules were consolidated into a spatial grammar grounded in collectively inherited settlement knowledge. Through this process, the spatial logic underlying intuitive settlement decisions transmitted across generations was analytically reconstructed, enabling tacit cultural knowledge to be articulated as a relational and transferable design framework.

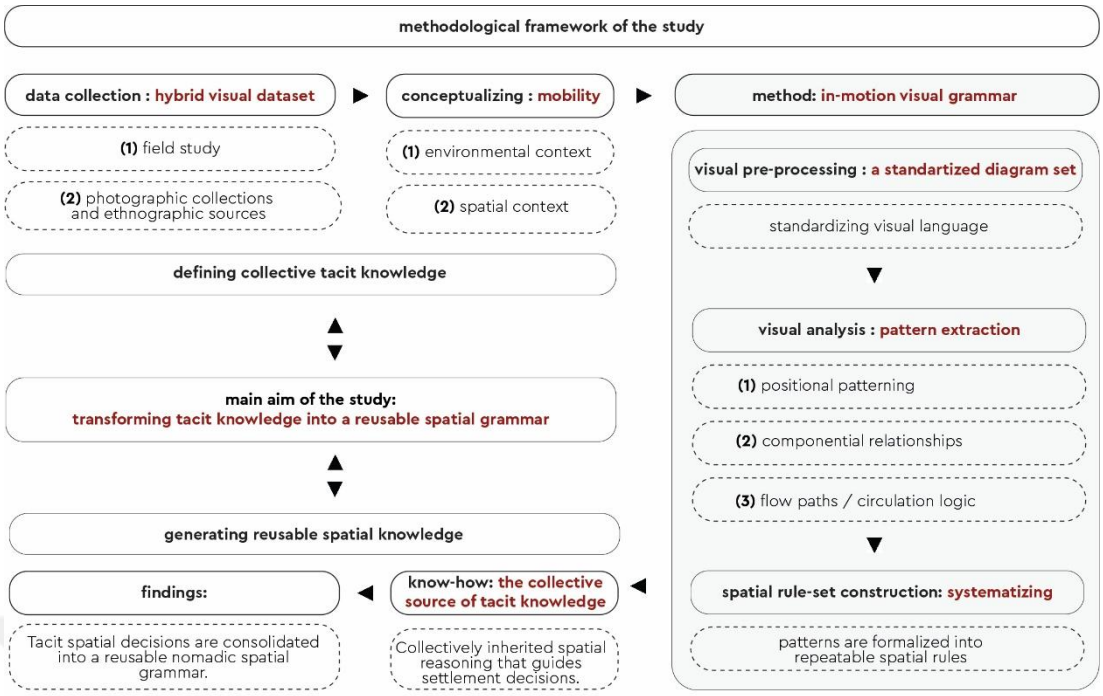

Figure 3.2: Methodological framework of the study (Source: Uçar and Gürer, 2026a).

The integrated methodological framework presented here supports the main aim of the study by systematizing the tacit, mobility-based spatial knowledge of the Yörük, one of the pastoral-nomadic cultures, through visual analysis.

3.2.2 Materials and data collection

The term Yörük, derived from the Turkish verb yörü- (to walk or move), describes a way of life based on habitual movement, environmental sensitivity, and spatial adaptability (İnalcık, 2014). Historically, Yörüks developed a settlement logic based on ephemeral, modular, and repairable structures that supported cyclical mobility while ensuring responsiveness to shifting environmental conditions (Andrews, 1997; Bates, 1973; Beşirli and Erdal, 2008; Ersavaş and Özkanlı, 2018). Their camps are centered around the karaçadır-a portable black tent woven from goat hair-and are strategically located in response to climatic, topographic, and ecological factors (Amoruso and Conte, 2022; Pfeifer, 2015; Uçar and Gürer, 2025) (Figure 3.3). Accordingly, black tents have become key indicators for observing the sequences of Yörük mobility patterns, especially during the moments when the camp is set up or dismantled. Building on this historical and spatial framework, the data collection approach employed in this study is explained in detail below.

Figure 3.3: Exterior (left) and interior (right) views of the Karaçadır, the central spatial unit of the Yörüks' mobile settlement system (Source: Uçar and Gürer, 2026a).

The hybrid dataset includes several forms of documentation: limited field observations conducted by the authors, historical and modern photographs from family archives and institutional collections, and secondary materials such as ethnographic studies, field notes and visual records.

Since the aim of the research is to uncover the tacit, mobility-based spatial knowledge embedded in Yörük settlement practices, the fieldwork comprised short visits to independently established camps at different times, specifically during the moments of setting up and dismantling. Examining these distinct and unrelated Yörük groups made it possible to identify shared spatial patterns that appear across communities, which is significant for understanding how tacit cultural knowledge is transmitted within a broader heritage system. It should be noted that the study does not rely on long-term ethnographic methods such as extended participant observation or continuous tracking of migration routes. This is a methodological limitation of the data collection process.

The primary data component of the study consists of observational notes, basic spatial measurements, and a limited number of settlement images collected during four short-term field visits conducted between 2023 and 2025. These visits were not intended to follow migration routes; rather, they aimed to document moments of establishment and departure, the spatial organization of temporary camps, and their relation to the environmental context. Conversations with Yörük families during fieldwork provided contextual insights. However, because the study focuses on spatial and visual patterns, these interviews were not incorporated directly into the analysis. As a result, the

findings draw on both primary field data and secondary visual sources, reinforcing the hybrid structure of the dataset.

The secondary visual dataset includes photographic archives and ethnographic research materials (Andrews, 1997, 1999; Bates, 1973; Beşirli and Erdal, 2008; Böhmer, 2004; Doğan and Doğan, 2004; Ersavaş and Özkanlı, 2018; Genç and Koyuncu, 2011; Lindner, 1983; İnalcık, 2014; Pfeiffer, 2015; Yeni, 2013; Zvelebil, 1980). This dataset was specifically filtered to include visual material in which the black tent is clearly visible and that depicts moments of establishment and dismantling.

Using this hybrid dataset, the study analyzes spatial relationships across six Yörük settlement instances. These six camps were selected because they represent the most spatially legible examples in the dataset and contain clearly identifiable components. Building on this hybrid dataset, the next section presents the analytical method used to examine the spatial logic embedded in Yörük settlement organization.

3.2.3 Method

3.2.3.1 Need for mobility-based visual systematization

Yörük settlements are approached as a spatial practice in which space is produced through mobility. Mobility, in this sense, refers not only to physical displacement but also to the relational reorganization that occurs during the cyclical processes of setting up and dismantling the camp. This mobility-based spatial formation shows that the configuration visible at any moment is the result of multiple layers of interaction accumulated over time. Although these dynamic processes appear as “frozen” moments, they still contain traces of the underlying spatial decisions and the processes that generate them. Thus, analyzing visual records that capture such moments makes it possible to reconstruct the spatial logic shaped by movement, even if movement itself is not directly documented.

Within this reconstruction process, the study emphasizes the need to transform visual data from different sources into a comparable analytical framework. To interpret the spatial relationships of Yörük camps established at different times, in different topographies, and by different groups, the data must be conveyed through a shared visual logic that goes beyond describing physical components and instead makes mobility-based spatial patterns visible.

The mobility-oriented visual systematization proposed in this study freezes selected moments of settlement and abstracts them into a diagrammatic language, enabling the underlying spatial logic to be compared across cases. This approach does not aim to represent Yörüks directly; rather, it focuses on the traces of their spatial interventions. In nomadic settlements, the meaning of space is shaped less by individual actions and more by the cumulative effect of collective practices. In this context, abstracting the user from the systematization process is not intended to conceal or exclude the Yörüks, but to highlight the shared spatial production principles that emerge through collective practice.

In sum, this study needs a mobility-based visual systematization approach to investigate the spatial organization logic embedded within Yörük settlement practices. The analysis specifically aimed to visually systematize the underlying principles that answer a main research question: "How have these tent groups been organized spatially?". By translating settlement configurations into visual patterns, the study aims to reveal the patterned logics that shape the spatial arrangements within Yörük communities.

3.2.3.2 Background of visual systematization

To systematically analyze the spatial organization of Yörük camps, this study employed a visual computation approach. At the core of this method is the use of shape grammars, which are rule-based systems that describe and generate patterns through the manipulation of two- or three-dimensional forms, without resorting to symbolic abstraction (Knight, 2000; Knight and Stiny, 2015; Stiny, 2006).

Building on prior expansions of shape grammar methodology-such as the lived-in grammar proposed by Rezoug and Özkar (2023) and user-centered adaptations of shape grammar (Ferreira et al., 2011; Eloy et al., 2018; Vardouli, 2015)-this study introduces an in-motion visual grammar approach. This methodological expansion aims to identify visual patterns that reflect spatial decisions with a rule-based logic. By analyzing the positional patterning, componential layout, flow and transition path, the study seeks to illuminate the design intelligence underlying nomadic spatial practices and contribute to a broader discourse on relational and adaptive design.

Beyond the case-specific analysis of Yörük settlements, the in-motion visual grammar approach also offers a transferable analytical framework applicable to other cultural

landscapes, mobility-based settlement systems, and everyday spatial practices. By identifying rule-based spatial patterns, the method reveals the relational logics embedded in the spatial decision-making processes of different communities and enables a systematic examination of how these practices interact with temporal, ecological and socio-cultural contexts.

In this regard, the approach contributes to understanding heritage ecologies as composed of multiple elements, connections, and interactions. It provides a means of interpreting the spatial patterns formed by people, places, environmental conditions, more-than-human actors, and circulating practices. In doing so, the methodology aligns with the heritage ecosystem perspective (ICOMOS, 2025) and supports contemporary discussions that conceptualize cultural heritage as a relational, multispecies, holistic, and contextually situated process.

3.3 In-Motion Visual Grammar

3.3.1 Pre-processing

In this study, the selected Yörük settlement instances were first transformed into a standardized schematic format to establish a coherent basis for visual analysis (Figure 3.4). Since the visual dataset consisted of hybrid materials, a unified pre-processing workflow was required to translate these diverse inputs into a comparable analytical language.

The process began with the identification of key spatial components visible in each source. Black tents, livestock enclosures, storage units, circulation traces, and auxiliary structures were isolated through contour-based interpretation, emphasizing their spatial footprints rather than their perspectival appearance.

Following this initial identification, each settlement instance was translated into a plan-based schematic drawing. Since many of the visual materials were perspective photographs, the conversion relied on spatial cues such as shadow orientations, tent entrances, ground markings, flock positioning, and topographic indicators recorded during field visits. Only components with sufficient clarity were included to ensure that the diagrams represented analytically reliable information rather than speculative reconstructions.

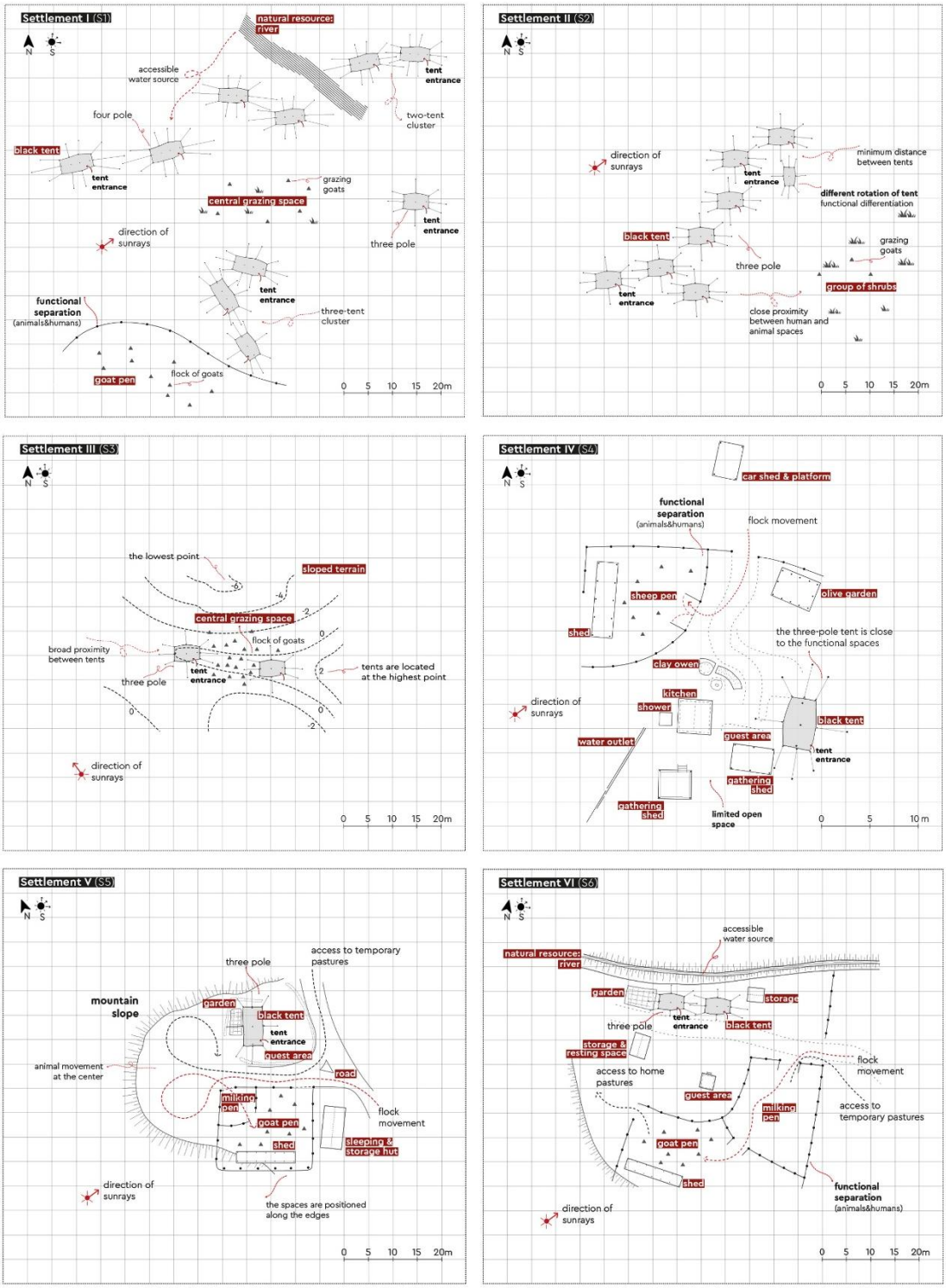

Figure 3.4: Matrix-based representation of six Yörük settlements (Source: Uçar and Gürer, 2026a).

To achieve comparability across cases, all drawings were then aligned within a consistent orientation frame. When cardinal orientation was available, it was directly applied; when absent, it was inferred from solar shadows, environmental context, or ethnographic notes, allowing all diagrams to be oriented with north placed upward.

This orientation harmonization was followed by the application of a uniform grid system, enabling the diagrams to be normalized at a relational scale. While exact metric measurements were not always available-particularly in historical sources-relative scaling was maintained using known tent dimensions, visible spatial intervals, and distances recorded during fieldwork.

The resulting standardized drawings were compiled into a visual matrix (Figure 3.4), placing all six settlements side by side to reveal structural similarities, divergences, and recurring spatial tendencies. Rather than functioning as literal cartographic reproductions, these diagrams abstract the spatial logic embedded in the moments of settlement and dismantle. This abstraction forms the analytical foundation for the in-motion visual grammar developed in the subsequent sections, prioritizing the representation of spatial decisions and relational patterns.

3.3.2 Visual analysis: Pattern extraction

Following the standardization of the visual dataset, the next stage of the method involved extracting spatial patterns from the six Yörük settlement diagrams. The analysis is structured around three interrelated parameters: positional patterning (5a), componential layout (5b), and flow and transition paths (5c). These parameters were selected because they capture different yet complementary dimensions of spatial organization (Figure 3.5).

Positional patterning focuses on the directional logic and clustering of tents, revealing how environmental factors inform settlement orientation. Componential layout examines the spatial relationships among key functional units, including black tents, livestock areas, storage or cooking zones, and open communal spaces, thereby revealing how human–animal separation, resource access, and modular organization are enacted across different camps. Flow and transition paths address the circulation structure within each settlement, tracing how movement, both human and non-human, shapes the spatial arrangement and reinforces the functional logic of temporary occupation. Together, these analytical layers provide a relational framework for understanding how mobility-based spatial intelligence is organized, negotiated, and sustained across settlement configurations. This layered reading also enables implicit settlement knowledge to be interpreted not as isolated spatial decisions, but as components of a coherent and adaptive organizational system.

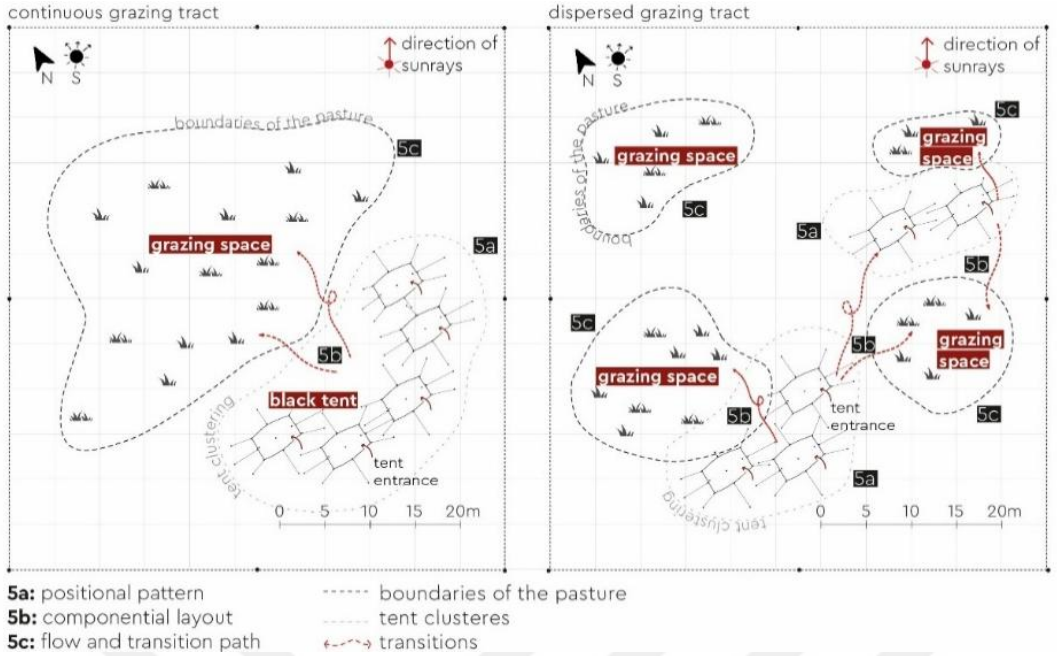

Figure 3.5: Spatial logic of nomadic camps: Positional patterning (5a), componential layout (5b), and flow and transition paths (5c) (Source: Uçar and Gürer, 2026a).

Together, these three parameters enable the identification of patterned similarities and context-driven variations across the six cases. While each parameter is examined individually in the following subsections, their combined evaluation allows the extraction of a visual grammar that underlies the Yörük spatial system.

3.3.2.1 Positional pattern analysis

This section focuses on analyzing the positional patterns observed across the six selected Yörük settlements. The aim is to understand how tents are directionally oriented and spatially clustered in relation to environmental conditions. The analysis examines the alignment of tent entrances, the presence or absence of central open spaces, and the overall spatial arrangement.

By comparing these spatial configurations, the analysis aims to identify recurring orientation logics and adaptive settlement strategies that reflect environmental reasoning embedded in nomadic spatial practices. These positional characteristics are visually synthesized in Figure 3.6, which consolidates schematic representations of all six camp layouts with overlaid spatial markers.

In Yörük Settlement 1 (S1), tents are predominantly oriented to the south, aligning with the direction of sun rays, and are loosely clustered around a central grazing space. The formation exhibits a semi-radial layout with tent groups organized in small

clusters separated by 25–30 meters, promoting airflow, mobility, and environmental comfort. This pattern reflects an open configuration that balances visual connectivity with decentralized flexibility.

S2 presents a more compact configuration. Tents are arranged in a partial arc facing southeast, forming a radial layout. The entrances uniformly face the sun, and the proximity between units (~5 meters) indicates a higher degree of spatial compression, likely responding to terrain constraints or climatic exposure. One rotated tent-perpendicular to the overall alignment-marks a spatial deviation, perhaps indicating hierarchical or functional differentiation.

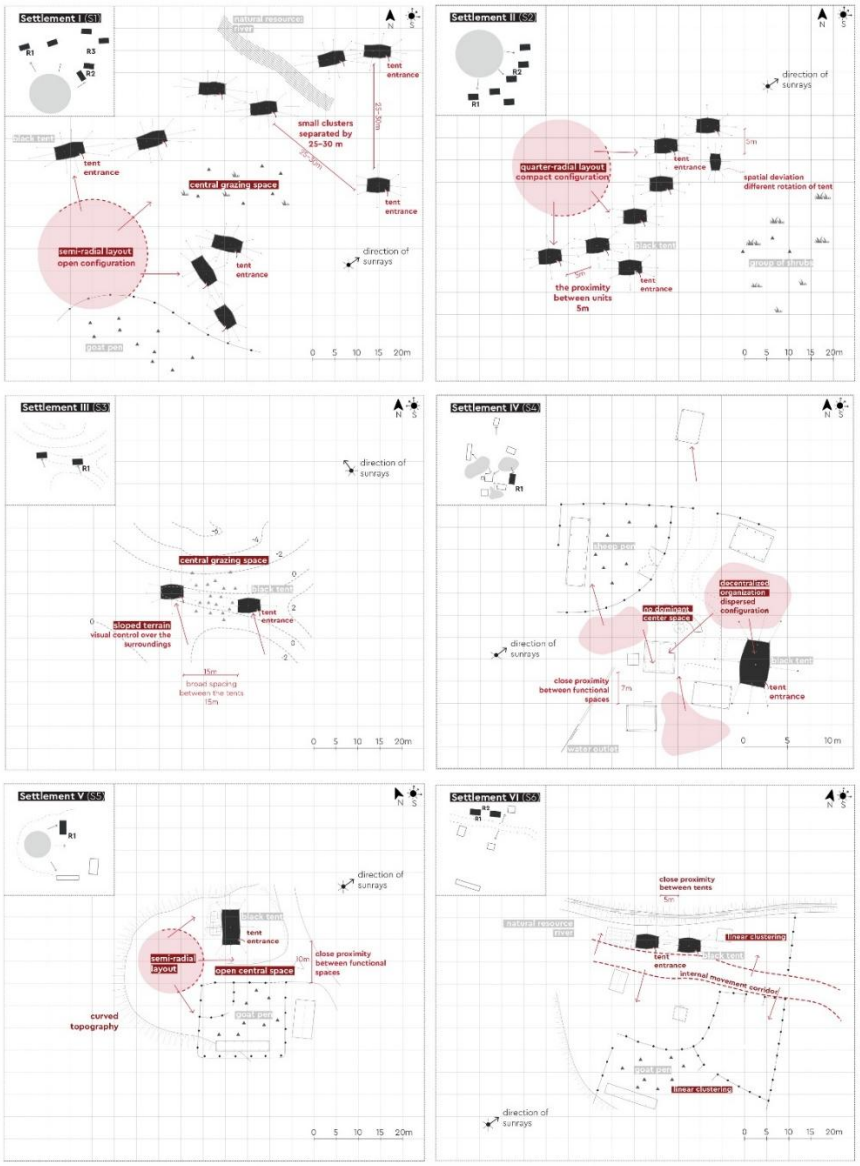

Figure 3.6: Positional pattern analysis of six main Yörük settlements (Source: Uçar and Gürer, 2026a).

S3 demonstrates a highly dispersed pattern. It consists of only two tents placed along a linear axis, facing southeast and overlooking a flock of sheep. The broad spacing between the tents and the strategic placement on slopes emphasize a visual control over the surroundings rather than spatial proximity. This formation reflects a fragmented positional logic typical of individual household camps or smaller transitory groupings.

S4 is arranged in a dense, spatially complex layout with no dominant central space. The black tent is situated near the southeastern corner, adjacent to garden, storage, and guest areas. Although tent orientation is not explicitly indicated, the arrangement suggests multidirectional access and a decentralized organization. The proximity of built elements suggests a more permanent or hybrid typology, where mobile and sedentary practices intersect.

S5 displays a semi-radial spatial arrangement within a defined enclosure. The living structures and animal pens are arranged along the edges, leaving the center open for livestock movement. The orientation logic is adaptive to the curved topography and offers a blend of openness and enclosure. This pattern allows for flexible access to temporary pastures while retaining internal organization.

Finally, S6 combines linear and clustered arrangements. The living zone follows a horizontal linearity along the top edge of the site, while the animal zones form two distinctive enclosed pens below. The relative openness between clusters and their orientation toward internal movement corridors reflects a dual logic: controlled boundary zones for animals and flexible living arrangements above.

3.3.2.2 Componential layout analysis

This section investigates the spatial relationships between core functional components within the six Yörük settlements. The analysis focuses on how black tents, animal enclosures, water sources, storage areas, and communal zones are positioned relative to one another. Key considerations include the functional separation between human and animal spaces, the proximity of water and pasture access points, and the spatial hierarchy or integration of domestic and productive areas.

Through comparative observation of componential layout, the aim is to reveal how everyday spatial decisions reflect both ecological adaptation and communal organization in mobility-based settlement patterns. These relationships are visually

illustrated in Figure 3.7, which overlays functional zoning onto each schematic representation.

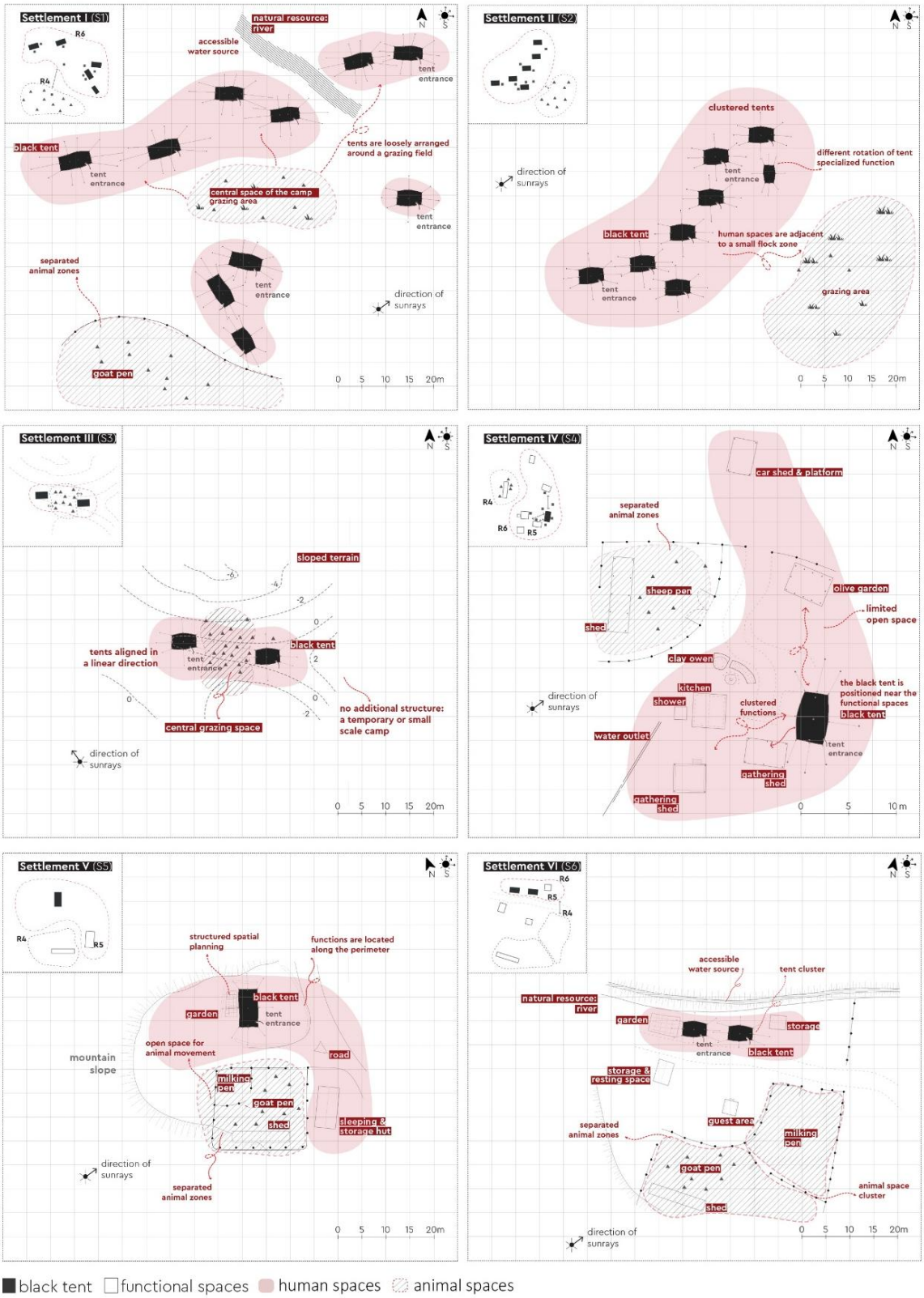

Figure 3.7: Componential layout analysis of six main Yörük settlements (Source: Uçar and Gürer, 2026a).

In S1, tents are loosely arranged around a grazing field located toward the central area of the camp. The animal spaces are clearly separated from the human zones, creating a buffer that supports mobility. Water sources are not immediately adjacent but accessible. This setup emphasizes a functional zoning model where different activities are spaced across terrain gradients.

In S2, the tents are tightly clustered and directly adjacent to a small flock zone, indicating a higher spatial density and functional overlap. The proximity of animal and human spaces suggests either spatial constraints or a short-stay configuration. A slightly rotated tent facing perpendicular to others indicate a specialized function, such as cooking or storage.

S3 reveals a minimal arrangement with two tents aligned in a linear direction. A small flock of sheep occupies the area just below the tents. The absence of additional structures or auxiliary zones indicates a temporary or small-scale camp, where human and animal spaces are only loosely separated.

S4 presents a more complex and layered layout. The black tent is positioned near storage, garden, and guest areas. The components are tightly grouped with limited open space between them, and the lack of clear separation suggests a hybrid living environment where sedentary and nomadic practices coexist. This layout implies increased permanence and integration of domestic and agricultural functions.

S5 follows a more formal organizational logic. Livestock pens and human spaces are clearly separated along the perimeter of an enclosed space, leaving a central zone open for animal movement. This creates a ring-like layout with clear functional zoning. Cooking areas and a well-defined circulation path further suggest structured spatial planning.

S6 combines two spatial clusters: the upper linear tent row and two lower livestock enclosures. The vertical division between functions allows for both proximity and control, with clear boundaries. Despite the separation, internal mobility paths connect these areas, showing an intentional arrangement based on practical needs.

3.3.2.3 Flow and transition path analysis

This section examines the circulation dynamics and transition paths that shape movement within and around the six Yörük settlements. The analysis focuses on the

spatial articulation of access routes, internal circulation, and the relationships between tent clusters, livestock areas, and shared activity zones. Key considerations include the presence of formal or informal circulation corridors, the openness or restriction of movement between functional areas, and the spatial logic that enables human and non-human mobility within the temporary camps.

By identifying how movement is accommodated, channeled, or facilitated, the analysis reveals how spatial strategies reflect the rhythms of nomadic life. These circulation logics are visually synthesized in Figure 3.8, which annotates movement paths over the schematic representations.

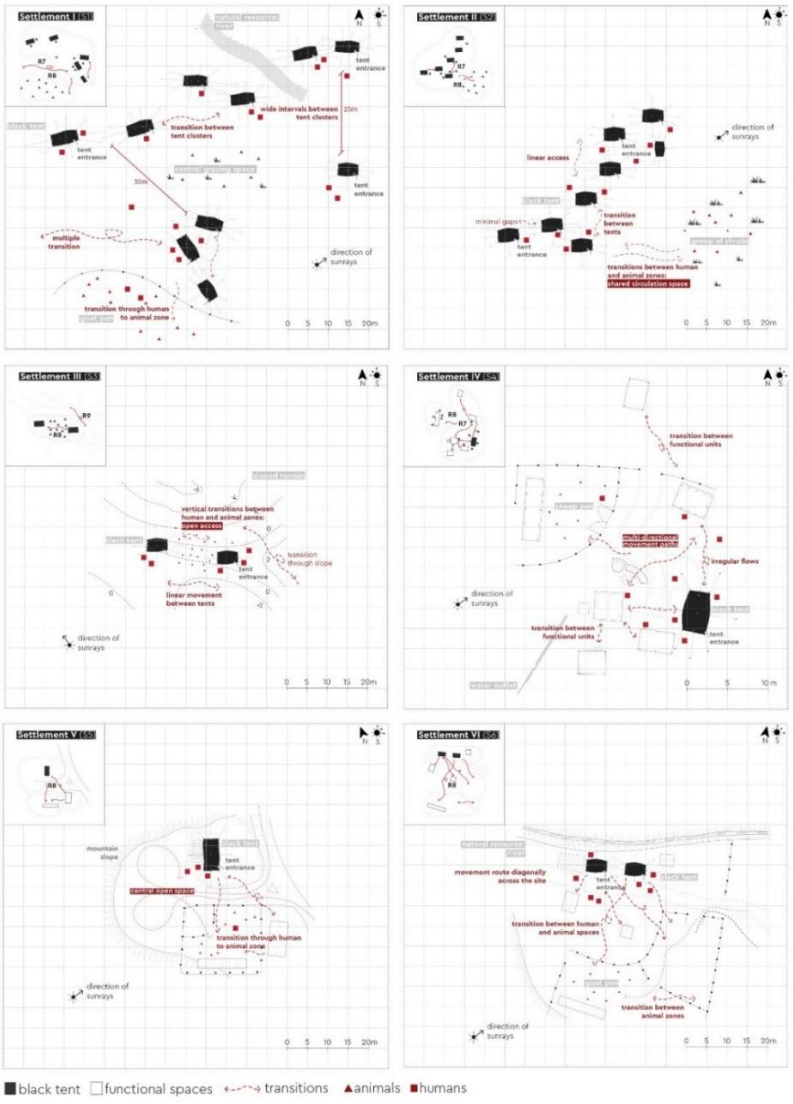

Figure 3.8: Flow and transition analysis of six main Yörük settlements (Source: Uçar and Gürer, 2026a).

In S1, wide intervals between tent clusters (approximately 25–30 meters) allow for multiple circulation routes. Movement flows are radial, enabling access both within

the camp and toward peripheral animal zones. This openness supports flexible navigation and herding activities without formal paths, embodying a spatial porosity that aligns with grazing-based routines.

S2 features a tighter spatial arrangement with minimal gaps between tents, resulting in more constrained movement. Internal circulation is likely informal and mediated by narrow passages. The orientation of all entrances in the same direction facilitates linear access, but cross-camp movement may be limited. The proximity of the flock suggests shared circulation space for both humans and animals.

S3 offers a linear and highly legible movement path along the axis between the two tents. The openness of the terrain enables direct navigation between the living areas and the grazing zone, with no apparent barriers. The simplicity of this layout indicates short-term occupancy with minimal infrastructural layering.

S4 exhibits a complex and irregular flow structure. Circulation occurs around and between compact functional units, such as garden, storage, and guest areas. Movement paths are fragmented and multi-directional, likely shaped by overlapping uses rather than planned corridors. This decentralized flow suggests hybrid use and a more sedentary mode of occupation.

S5 demonstrates a semi-structured flow network. The central open space serves as a shared circulation and activity zone, with clearly defined movement routes radiating from the center to the periphery. The separation of animal pens and living units enhances spatial clarity, allowing herding and domestic paths to coexist without interference.

In S6, circulation follows a vertical logic connecting upper tent rows with lower livestock enclosures. Paths appear to flow diagonally across the site, linking clusters through open gaps. This facilitates internal connectivity while maintaining separation between functions. The overall movement structure supports daily care routines and reinforces spatial zoning.

3.4 Findings

Based on the three parameters outlined above, a set of spatial rules (R1–R9) was extracted to formalize the underlying logic of Yörük settlement organization. These rules articulate conditional spatial relationships that recur across the majority of cases.

As summarized in Figure 3.9, each rule is defined by the condition under which it emerges, the resulting spatial configuration, and its observed frequency and exceptions.

The first group of rules concerns positional patterning. R1 shows that tents placed on open terrain tend to orient their entrances south or southeast. R2 captures the internal spacing logic of tents. When multiple tents belong to the same household or cooperative unit, they typically maintain a spacing of approximately 4–5 meters. As an exception, two-tent micro-settlements tend to form simple linear alignments rather than clustered configurations. At a broader scale, R3 indicates that multiple tent clusters typically maintain a 20–30 meter buffer to accommodate herd circulation, reduced only in topographically or physically constrained areas.

The second group addresses componential layout. R4 reflects the consistent spatial separation of tents and livestock areas, with animal pens positioned along the periphery. R5 describes the placement of auxiliary units-such as storage, cooking or garden zones-which tend to be located near the main tent yet outside main circulation. R6 concerns resource-oriented positioning: when on-site water is available, washing and cooking areas align with the shortest unobstructed path to the source.

The third group concerns flow and transition patterns. R7 demonstrates that dispersed layouts generate open, multi-directional circulation routes. R8 defines a condition in which a central open space creates a radial movement pattern connecting the tents and animal areas. R9 describes vertical movement: when spaces are on different elevations, people move through stepped paths.

Together, these nine rules form a spatial grammar that does not operate as a rigid template but as a context-responsive set of generative principles. In combination, R1–R9 reveal how mobility patterns -orientation, functional zoning, interspecies separation and auxiliary placement- interact to produce the resilient and adaptive spatial configurations characteristic of Yörük mobile lifeways.

While each Yörük settlement analyzed in this study reflects a distinct environmental setting, group composition, and degree of permanence, the spatial analyses reveal a convergence in underlying spatial strategies. Despite topographical and contextual variations, the camps show consistent patterns of orientation, zoning, and circulation that suggest the presence of an embedded spatial intelligence. These convergences

point to a shared grammar that is not formally codified but culturally transmitted and pragmatically enacted. These findings directly correspond to the visual patterns extracted through the three analytical parameters (positional patterning, componential layout and transition paths) and the rule set.

Rule ID	Condition (If)	Results (Then)	Frequency	Exceptions
R1: Solar-Oriented Entrances	If tents are positioned on relatively open terrain.	Entrances face south or southeast to maximize solar exposure.	6/6 (S1;S2;S3; S4;S5;S6)	No exception.
R2: Intra-Cluster Spacing	If multiple tents belong to the same household or cooperative unit.	Tents with approx. 4–5 m spacing.	3/6 (S1;S2;S6)	Two-tent micro-camps produce linear alignments instead of clusters.
R3: Inter-Cluster Buffer	If more than one tent cluster is established.	Clusters maintain 20–30 m spacing to allow herd circulation.	1/6 (S1)	The absence of clustering
R4: Human–Animal Functional Separation	If a designated livestock area is present.	Animal zones occupy peripheral positions relative to tents.	4/6 (S1;S4;S5;S6)	Highly compact setups may place animal pens directly adjacent.
R5: Auxiliary Function Placement	If storage, cooking or garden units are used.	They are positioned near the main tent but kept outside main circulation.	3/6 (S4;S5;S6)	Very temporary camps omit auxiliary units.
R6: Resource Oriented Zoning	If an on-site water source exists.	Water-related activities orient along the shortest path to the source.	3/6 (S1;S4;S6)	No pattern when water is collected off-site.
R7: Open Circulation Fields	If settlement layout is spatially dispersed.	Movement remains open, multi-directional.	3/6 (S1;S2;S4)	None; dispersion inherently keeps paths open.
R8: Central Circulation Logic	If a central open space is present.	Circulation becomes radial, linking tents, paths and animal areas.	6/6 (S1;S2;S3; S4;S5;S6)	No exception.
R9: Vertical Movement	If human and animal zones are vertically separated by slope.	Circulation follows diagonal or stepped linkages between levels.	1/6 (S3)	Flat sites show no vertical segmentation.

Figure 3.9: Rule set for Yörük settlements (Source: Uçar and Gürer, 2026a).

The positional patterns observed across the six settlements demonstrate recurring alignment toward solar exposure (most commonly south or southeast) as well as flexible clustering strategies. Camps alternate between openness and compact linearity, often shaped by terrain constraints, herd behavior, and desired visibility. These tendencies correspond to rules; (R1) solar-oriented entrances, (R2) intra-cluster spacing of 4–5 meters and (R3) inter-cluster buffers of 20–30 meters where herd circulation is required. Central open areas are present in more distributed camps, while denser configurations accommodate multidirectional access. The tent entrances commonly face south, maximizing solar exposure and aligning with prevailing environmental flows, thus promoting both thermal comfort and inter-cluster

communication. The consistency of this orientation, even across camps established at different times, demonstrates that environmental reasoning is a stable cultural parameter rather than a site-specific choice.

The componential layouts appear in repeated patterns of functional separation and resource-based orientation. Human habitation spaces and animal zones are typically distinct, often organized across topographical thresholds or spatial buffers. This reflects R4 (human–animal functional separation), indicating that functional concerns shape spatial differentiation. Auxiliary functions appear when permanence increases, but their spatial positioning remains responsive to terrain and group size. These patterns correspond to R5 (auxiliary function placement) and R6 (resource-oriented zoning), both of which show selective activation depending on camp duration and water availability. This is evident in the recurring spatial organizations observed across most Yörük campsites: a central tent for rest and hospitality, an outdoor kitchen, a gathering space, and animal pens at peripheral edges.

The flow and transition paths also reflect spatial principles. These principles align with R7 (open circulation fields), R8 (central circulation logic) and R9 (vertical movement). Transition patterns transform predictably according to density and slope, indicating that circulation is an emergent but rule-consistent outcome of settlement configuration. Across all settlements, circulation pathways are not formally bounded but emerge through habitual movement, shared access needs, and interspecies negotiation. Rather than fixed routes, mobility unfolds through open fields of action shaped by daily routines and communal rhythms. This dynamic aligns with the “in-motion” analytical framework and demonstrates how spatial rules are enacted through repeated, embodied practices rather than explicit planning.

Each of these rules (R1–R9), demonstrates that the visual grammar approach not only identifies recurring tendencies but also formalizes them as re-usable principles. In this sense, the findings validate the methodological contribution of the study, which stands in the ability of an in-motion visual grammar to extract tacit cultural knowledge from hybrid visual data. Through this lens, Yörük camps emerge as living heritage ecosystems that are dynamic, negotiated, and multispecies environments that challenge dominant sedentary models of preservation. Ultimately, mobility is not merely contextual but constitutive of the settlement system, affirming mobility as a cultural logic with heritage-forming capacity.

3.5 Conclusion

This study has explored the spatial intelligence embedded within Yörük settlement practices by examining the visual patterns. Through an in-motion visual grammar approach, it has uncovered a culturally transmitted yet uncodified visual grammar that sustains ecological responsiveness and interspecies coexistence through mobility.

The findings derived from positional, componential, and transitional analyses directly validate the rule set (R1–R9) generated in Section 4, demonstrating that the methodological framework translates visual patterns into systematic spatial principles. These findings not only contribute to the empirical understanding of nomadic spatial practices but also invite a broader reframing of cultural heritage through the lens of mobility, adaptability, and multispecies negotiation.

Rather than defining heritage as a fixed inventory of tangible artifacts or architectural remains, this research positions it as a dynamic ecosystem that evolves through situated interactions among humans, animals, and environment. This perspective aligns with the conceptual framework articulated in the Gunma Prefecture (ICOMOS, 2025), which calls for an integrative, inclusive, and more-than-human approach to heritage management. The Yörük example illustrates the value of such an approach by demonstrating how mobility, adaptability, and multispecies negotiation come together to form sustainable modes of inhabitation. In this sense, mobility is not a sign of instability but a deliberate design choice, shaped by long-term cultural practice and ecological know-how.

The implications of this study extend beyond ethnographic specificity. Methodologically, the research demonstrates that hybrid visual data can be systematically analyzed through a rule-based visual grammar to unveil tacit spatial knowledge. This offers a re-usable approach for other mobile, ephemeral, or undocumented heritage systems. Analytically, the study refines mobility-centered heritage research by showing that patterned logics can be extracted from short-term, spatial documentation when processed through a structured visual framework. For policy and heritage practice, the rule set (R1–R9) provides a transferable grammar that can support design guidelines, conservation, and cultural management for communities whose spatial practices remain non-sedentary. By identifying visual

patterns that operate as cultural rules rather than isolated decisions, the research offers an approach for avoiding sedentary bias in heritage assessments.

By viewing mobility as a rule-based system instead of just displacement, the research questions the permanent assumptions in heritage studies. The study shows that mobile heritage ecosystems can be legible, analyzable, and systematically interpretable, affirming that mobility-based cultural knowledge is deeply structured. As such, the Yörük camps analyzed here function not merely as temporary settlements, but as spatial expressions of an ecological epistemology. This has particular relevance for contemporary heritage discourse, which increasingly addresses climate change, forced migration, and the pressures of urbanization. The findings reinforce that adaptive, low-impact, and relational forms of inhabitation long practiced by nomadic communities offer valuable lessons for sustainable futures.

Despite these contributions, the study is subject to several methodological and interpretive limitations. First, the analysis is based on short-term field observations and visually documented moments rather than long-term ethnographic methods such as extended participant observation or continuous tracking of migration routes. Long-term ethnography would enable closer engagement with Yörük communities and allow to observe how spatial decisions are shaped by lived subjectivities within these communities, including factors such as age, gender, kinship, household roles, authority, and the distribution of roles and responsibilities. Such extended involvement would help reveal the discussions, negotiations, and motivations behind spatial practices. These social and relational aspects, which give meaning and context to spatial rules, cannot be fully captured through visual data alone. Therefore, long-term ethnographic work would offer a richer understanding of the rule-based spatial patterns identified through the in-motion visual grammar approach.

Second, the six camps examined represent spatially legible and accessible examples, meaning that the diversity of Yörük settlement practices across regions, terrains, and socio-economic contexts cannot be fully captured. Third, the in-motion visual grammar approach captures recurring spatial rules (R1–R9) but does not account for the motivations, kinship ties, or decisions that produce them. These limitations do not undermine the analytical value of the rule set but highlight the need for complementary ethnographic, participatory, and computational methods to further deepen the understanding of mobility-based heritage systems.

Looking forward, the findings of this study suggest several future directions:

(1) expanding rule-based visual methodologies to other pastoral groups,

(2) integrating computational approaches such as agent-based modeling or generative design to simulate nomadic spatial logics,

(3) incorporating non-human agencies as analytical variables in computational heritage models,

(4) developing heritage policies that recognize mobility as a cultural right and a spatial knowledge system.

In this light, the Yörük settlement system serves not only as a subject of analysis but as a conceptual resource, functioning as a living archive of ecological adaptation, heritage transmission, and communal design intelligence. Ultimately, this study affirms that heritage ecosystems, when understood as distributed, adaptive, and multispecies, can offer resilient alternatives to extractive models of heritage preservation. By embracing mobility as both a spatial and epistemological strategy, heritage management can begin to move toward futures that are not only inclusive and sustainable but also richly connected to the lived intelligence of diverse cultural lifeways. The Yörük case demonstrates that cultural continuity can emerge not from permanence but from adaptive iteration, an insight that is increasingly relevant and urgently needed in this era of environmental uncertainty.

4. INTEGRATING VERNACULAR ARCHITECTURAL KNOWLEDGE INTO GENETIC ALGORITHMS: A CASE STUDY ON KARAÇADIR[3]

4.1 Introduction

In architectural design processes, optimization techniques are increasingly integrated to enhance efficiency and generate a greater number and variety of design variations. One of these optimization methods, genetic algorithms (GAs), stands out for its ability to systematically explore vast design spaces inspired by biological evolution processes. However, traditional GA-based optimization processes often fail to incorporate specific architectural knowledge systems, leading to the generation of variations that are disconnected from context, functionally inadequate, or inconsistent with fundamental design principles. The exclusion of architectural knowledge systems from computational methods significantly reduces the effectiveness of optimization processes and limits their integration with practical design applications.

This study aims to address these shortcomings by introducing a computational framework that systematically integrates vernacular architectural knowledge (VAK) into GA-based optimization processes. The main rationale for employing GAs in this study lies in their strong alignment with the inherent characteristics of VAK, which has evolved over time through adaptive responses to environmental, structural, and cultural constraints. Rather than being the result of a single-variable logic, VAK reflects multi-parametric optimization process-making GAs, as evolutionary search methods, particularly well-suited for navigating complex and dynamic design spaces. GAs differ from other generative approaches by enabling populationbased search, iterative fitness evaluation, and non-deterministic exploration. They also support regular design assessment, continuous improvement, and the simultaneous generation

[3] This chapter is based on the article: Uçar U.E., Gürer E., Integrating Vernacular Architectural Knowledge Into Genetic Algorithms: A Case Study On Karaçadır, published [2025], [© 2025 Internationa Journal of Architectural Computing]
https://doi.org/10.1177/14780771251405225

of multiple alternatives (Singh and Gu, 2012). Accordingly, their use in this study represents a deliberate methodological choice to model the evolutionary, component-based, and context-sensitive nature of VAK within a computational framework.

The proposed approach incorporates architectural constants revealed from VAK into the algorithm, aiming to enhance both the contextual relevance and efficiency of design variations. To operationalize the integration of VAK into GAs, this study introduces Rule-Based Design (RBD) as an intermediary layer. While VAK provides the cultural foundation rooted in traditional making logics, RBD translates this into

structured rule sets suitable for algorithmic use. Acting as both a methodological tool and an epistemological bridge, RBD anchors the generative process in culturally embedded knowledge. The resulting VAK–RBD– GA framework enables the transfer of tacit spatial intelligence into computationally operable systems.

VAK has evolved over centuries through adaptation to environmental, cultural, and structural factors, surviving by continuously optimizing against real-world challenges. Therefore, integrating extracted constants based on VAK with GAs through rules is intended not only to guide the optimization process but also to make it more meaningful and contextually coherent. The first phase of this research focuses on introducing the proposed GA framework, identifying and formulating architectural knowledge-based rules and constants within this framework. This phase aims to enhance the optimization process by minimizing suboptimal variations while maintaining structural integrity and functionality.

In the second phase, the validity of the proposed approach is tested through a case study on Karaçadır, a traditional tent of the Yörüks, a nomadic culture in Anatolia that has preserved VAK for centuries. This phase utilizes fundamental architectural elements-cover modules, load-bearing structures, and connectors-to generate optimized configurations that align with traditional construction logic. Considering these contextual attributes, the case study evaluates the scenarios in which genetic algorithms can develop more efficient design solutions. The integration of VAK into the design optimization process provides a systematic methodology that balances algorithmic exploration with intangible architectural cultures. Thus, the design process is not limited to generating variations but becomes a knowledge-driven decision-making mechanism guided by the designer.

This research has three main objectives: (1) to establish a methodological framework for extracting and integrating VAK into GA-based design optimization processes through rules, (2) to evaluate the impact of extracted architectural knowledge-based constants and rules on efficiency and solution relevance, and (3) to investigate the broader implications of VAK-based optimization for architectural design computing. In this context, the study redefines the optimization process not merely as a quantitative variation and evaluation process but as a paradigm supported by contextual, traditional, and cultural data. By synthesizing algorithms with architectural intuition, this study proposes an optimization process that is both context-sensitive and operationally efficient.

This study critically revisits conventional optimization approaches that prioritize formal variation, and instead positions optimization as a knowledge-driven design process grounded in cultural logic. While generative simulations of traditional forms have been widely explored in the literature, the direct integration of architectural constants and culturally embedded rules into optimization algorithms remains notably limited. Addressing this gap, the paper proposes an innovative framework that encodes VAK into GAs-not merely as symbolic reference, but as functional input for both variation generation and solution evaluation.

In particular, this research aligns with and extends the discourse on “digital vernaculars”, which often seeks to connect algorithmic design with local building cultures but tends to remain at the level of geometric representation (Suzuki and Knippers, 2018). In contrast, this study embeds culturally derived rules directly into the operative logic of optimization, offering a more holistic and computationally robust framework. Furthermore, by explicitly situating itself within emerging discussions on culturally aware generative design (Harsono et al., 2024; Salter and Johnson, 2025), this research contributes to a growing body of work that aims to synthesize tradition with algorithmic design systems.

4.2 Materials and Methods

4.2.1 Materials

In the literature, classifications of nomadic cultures include the definition of pastoral nomadism (Barnard and Wendrich, 2008; Gilbert, 2014), which encompasses criteria

such as reliance on herd animals as the primary means of subsistence (Hole, 1978), the social organization of communities engaged in animal husbandry (Tapper, 1979), a pastoral ideology based on herd ownership (Ingold, 1980), and asymmetric economic dependency relationships with sedentary agricultural societies (Khazanov, 1984). Within this framework, the Yörüks, the focus of this study, can be classified as pastoral nomads (Barfield, 2012; Zvelebil, 1980).

As pastoral nomads, the Yörüks undertake seasonal transhumance between summer pastures and winter quarters twice a year to secure adequate grazing for their livestock (Doğan and Doğan, 2004; Ersavaş and Özkanlı, 2018; Yeni, 2013). Originating from the steppe empires of Central Asia and continuing through the Seljuk and Ottoman periods, the Yörük culture has persisted into the present day, maintaining a similar way of life in Anatolia (Beşirli and Erdal, 2008; Lindner, 1983; İnalcık, 2014).

Throughout this historical trajectory and the transhumance process, a fundamental component representing Yörük culture has been their traditional tent, the Karaçadır (Figure 4.1). The Karaçadır is a vernacular architectural typology that has adapted to the climatic and spatial needs of nomadic communities. Throughout history, this structure has been characterized by its flexibility and modularity during the practice of transhumance (Genç, 2020; Genç and Koyuncu, 2011).

Figure 4.1: Exterior (left) and interior (right) views of the Karaçadır (Source: Uçar and Gürer, 2025).

Structurally adapted to pastoral nomadism, Karaçadır is covered with woven covers made from livestock hair and stretched over wooden poles, which are anchored to the ground using connectors. The primary structural system of the Karaçadır consists of vertical load-bearing elements and tension ropes that support the interior space. At the same time, the external cover can be lifted at specific points (Genç, 2020; Genç and Koyuncu, 2011). The load-bearing elements are traditionally crafted from hardwood

and are stabilized through tension forces during assembly. Internally, the Karaçadır space is subdivided with covers to create distinct functional areas. Consequently, the Karaçadır can be understood as a composition of three primary design components: load-bearings, covering elements, and connectors (Figure 4.2). The structural variations of the Karaçadır emerge from different dimensional and quantitative repetitions of these components, allowing for a range of configurations.

4.2.2 Methods and related concepts

This section introduces related concepts and terminology necessary for integrating implicit vernacular architectural knowledge (VAK) into the design optimization process as a rule-based design (RBD) and specifically for incorporating it into genetic algorithms (GAs).

4.2.2.1 VAK as a naturally optimized design system

VAK as a naturally optimized design system. Vernacular Architectural Knowledge (VAK) can be defined as an optimized design system shaped by environmental and cultural constants (Oliver, 2003; Rapoport, 2006). This optimization system has emerged as a result of real-life problem-solving over generations, where inefficient or unsustainable solutions have been gradually eliminated through an iterative process of adaptation. As a naturally optimized design system, VAK is governed by empirical knowledge and design intelligence embedded in traditional architectural practices (Asquith, 2006). Learning from this design intelligence rather than merely replicating it is essential for sustainable design, as it allows for the integration of tradition and innovation in a creative process (Bonner, 2006; Fathy, 2010; Oliver, 2003).

Figure 4.2: Design elements of Karaçadır: Tension system- Connectors (left), load-bearings (center), and modular covering system (right). (Source: Genç, 2020)

Vernacular knowledge in architecture often remains implicit, as designers intuitively discover relationships between design elements, frame them through rules, and apply variations without fully articulating their reasoning (Cross, 1982). Given its embedded nature, the extraction and systematization of design knowledge are necessary for integrating it into computational design (Uçar et al., 2023). Thus, re-examining vernacular architecture using computational design tools is essential for understanding its potential contributions (Gencer and Karadağ, 2022; Gülmüş et al., 2024).

In this regard, VAK, as a naturally optimized system, holds potential knowledge that can be transferred to the design optimization process. By conceptualizing VAK as an optimized system enriched with implicit knowledge, it becomes possible to identify the fundamental architectural parameters and constants that persist due to their functional efficiency and contextual adaptability. These parameters and constants, derived from empirical adaptation, provide a foundation for deeper explorations, offering potential insights into how design optimization can benefit from the VAK approach.

4.2.2.2 RBD as a foundational model for GAs

This study aims to uncover the implicit knowledge embedded within VAK by identifying parameters and constants that can be utilized within GAs. GA is adopted in this study due to its suitability for addressing multi-parametric, non-linear, and exploratory design processes- characteristics that align closely with the evolutionary nature of VAK. By structuring GA operators around culturally informed rules and performance criteria, the study seeks not only to optimize design outcomes, but also to reveal the architectural logic embedded in vernacular systems. In this context, integrating a mode of thinking that establishes a connection between VAK and GA is essential for defining these parameters and constants. To bridge this link, the study employs RBD as an intermediary layer for formalizing vernacular principles into operable rules.

Rule-based design (RBD) provides a systematic framework wherein rules collectively form a broader set of proportions and conditions, and the encoding of specific facts implies the possibility of encoding others (Knight and Stiny, 2015; Sloman, 1996; Stiny, 1980). The historical foundations of the RBD approach can be observed in Vitruvius' classical column system, Alberti's Doric pedestal design, and Palladio's

Doric order. Each of these examples represents systems governed by predefined standards and rules. Every component within these systems possesses a distinct form and name, and the process of assembling these components i.e., the composition process- occurs within a structured framework of rules (Carpo, 2003; Yazıcı, 2020).

Beyond its role in revealing embedded design logic, RBD also holds potential as a foundational model for GA, a relationship directly tied to its generative nature. The structured logic of rule-based systems enables the systematic exploration of design variations, making it particularly valuable in computational design and algorithmic processes (Sydora and Stroulia, 2020; Uçar et al., 2025; Zhang and Li, 2025). Design rules are described as directives that guide the design process towards the product (Lee et al., 2025; Özkar, 2015). The ability to define these rules in multiple ways or apply the same rules in different forms allows rule-based processes to generate a vast number of potentially complex solutions (Bernal et.al, 2015; Bukhari, 2011; Caetono et al., 2020; Fasoulaki, 2008; Oxman, 2008).

The adaptability of the RBD approach is particularly useful in computational design environments, where variations and iterative refinements play a crucial role in exploring optimal configurations. In conclusion, due to its capacity to reveal implicit knowledge and its generative nature, RBD has been applied in this study as a mode of thinking that can be positioned between VAK and GA.

4.2.2.3 GAs as an evolutionary method for VAK-based optimization

Traditionally, GAs are potent and effective computational methods developed based on the principle of natural selection, mirroring evolutionary processes in nature (Gen and Lin, 2023; Holland, 1975). In architectural design, GAs are implemented for design evaluation and improvement, generating multiple solutions, and facilitating optimization. Notably, their ability to create solution proposals while considering multiple parameters establishes them as an effective method for addressing architectural design challenges (Garip et al., 2023; Rahimbakhsh et al., 2022). However, the computational nature of GAs, which requires processing a large number of parameters, makes them time-consuming and computationally demanding.

Therefore, advancing design optimization techniques is crucial for designers (Chi and Xu, 2022; Su and Yan, 2015; Yan et al., 2022). GAs aim to identify optimal solutions within a search space by applying evolutionary operators to a population to maximize

a fitness function (Gero and Kazakov, 1998; Vukadinovic et al., 2021). In line with this definition, the fundamental components of GAs include genotypes, phenotypes, population, genetic operations, and the fitness function. The search space, composed of genotypes-character strings of fixed or variable length derived from a given set of alleles-is mapped onto another search space, the phenotype, where the fitness function is evaluated based on the state in the phenotype space (Grabska, 2022; Singh and Gu, 2012).

Building on this foundation, this study adopts GAs due to their demonstrated capacity to address multivariable,m evolutionary design problems-particularly those involving culturally complex optimization criteria, as in the case of digital vernaculars. Their ability to population-based search, iterative fitness evaluation, and non-deterministic exploration renders them especially suitable for engaging with the embedded complexity of VAK. In the context of the Karaçadır case, GAs are leveraged to develop adaptive design proposals rooted in traditional construction logic. Nonetheless, the limitations of GAs in encoding culturally specific rules or constraints necessitate the integration of RBD as an intermediary layer. This hybrid VAK+RBD+GA approach addresses the generative limitations of standalone GA models by embedding culturally derived rules into the optimization structure, thus enhancing both contextual relevance and computational efficiency.

This section has established the conceptual foundation for employing RBD as a methodological framework to transfer the knowledge embedded in VAK into GAs. Accordingly, the tangible implementation of this background in the study is demonstrated through the following stages: defining the components that constitute Karaçadır as the material focus of the study (VAK), establishing the rules governing the assembly of these components to form Karaçadır structures (VAK+RBD), abstracting these components for integrating them into the structured optimization process (VAK+RBD+GAs). A detailed discussion of this implementation is presented in the analysis section.

4.3 Analysis

No significant differences are observed among the Karaçadır typologies in terms of fundamental architectural elements; instead, only dimensional variations are present. These dimensional variations are associated with the necessity for the Karaçadır to

possess a flexible and modular structure. Since Karaçadır exhibits a system in which a specific proportional relationship is scaled up or down, no significant difference is expected between evaluations conducted on a single example and those based on multiple examples in the analysis process.

The production of two-dimensional plan drawings was based on on-site measurements. However, due to Karaçadırs being examples of vernacular architecture, variations in formal precision were observed, which were considered a limitation of the study. Since parameters such as the tensile angles, distances, interior measurements, interior height, and dimensional characteristics of openings are entirely dependent on the specific setup at a given moment and thus subject to variation, they were excluded from the study. Instead, the research was structured around the number of architectural components used and the spatial configurations they define.

4.3.1 VAK: Architectural elements of karaçadır

Karaçadır is a vernacular architectural structure designed to protect while maintaining flexibility and adaptability to various environmental conditions. It belongs to a category of shelters known as woven tents due to its unique manufacturing method, in which the fabric is produced by weaving black goat hair. This material is specifically chosen for its durability and insulating properties, making it well-suited for the nomadic lifestyle of the Yörük communities (Figure 4.3).

One of the fundamental architectural elements of Karaçadır is its modular covering system. The cover is woven in separate, wing-like modules, which are stitched together along their long edges using a specialized sewing method that involves tent ropes and large needles. Each cover module, made of tightly woven goat hair, measures between 50 cm and 70 cm in width. The modular nature of the Karaçadır allows for adjustments in size and reassembly to meet varying spatial needs. Typically, the structure consists of five or seven cover modules, which determine the overall dimensions and configuration of the tent. To ensure precision in their alignment, the cover sections are laid out on the ground and temporarily secured using wooden stakes before being stitched together. Once the wings are assembled, the tent's tensioning system is integrated (Figure 4.3(c)).

Another crucial architectural element of Karaçadır is its load-bearing system, which ensures structural stability and secures the tent to the ground. This system consists of

multiple connectors, the number of which varies depending on the tent's configuration. Five-module Karaçadırs have eight bindings, whereas sevenmodule versions require 10, corresponding to 10 anchoring points. The primary load-bearing components of the Karaçadır are the vertical poles, typically two and a half meters in height. These poles are inserted into custom-fitted wooden bases positioned at the intersection points of the structural belts, preventing fabric tears at points of direct contact (Figure 4.3 (a)).

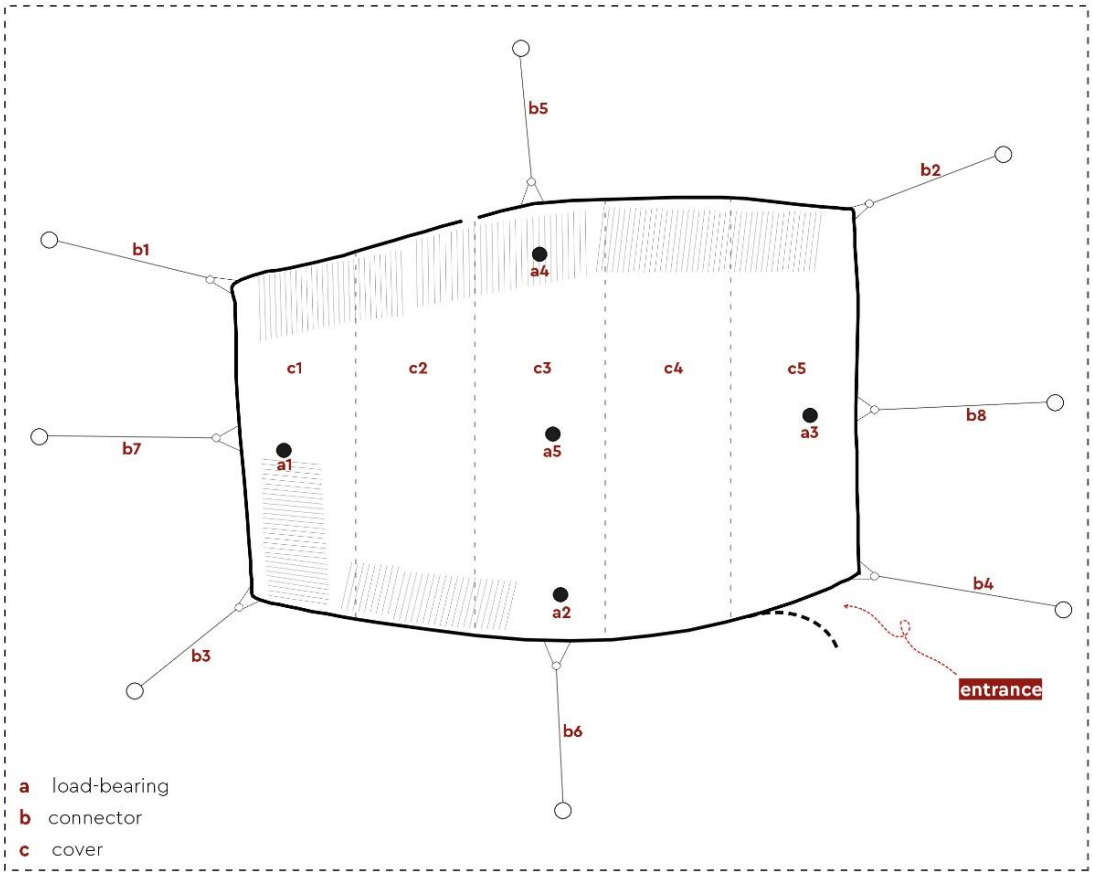

Figure 4.3: Diagrammatic plans of typical Karaçadır's architectural elements: Load-bearing elements (a), connectors (b), and cover modules (c) (Source: Uçar and Gürer, 2025).

Karaçadır's structural flexibility, efficient anchoring system, and environmental adaptability make it a refined example of vernacular architecture. The integration of tensioning mechanisms with connectors, protective cover extensions, and specialized load-bearing elements ensures both structural integrity and resilience against environmental conditions (Figure 4.3(b)). Additionally, the meticulous craftsmanship, from the preparation of goat hair to the modular assembly process, reveals the VAK

approach embedded in the intangible cultural heritage of the Yörük people, particularly in the construction of Karaçadır.

4.3.2 VAK+RBD: Revealing VAK through the rules of karaçadır

The making process of Karaçadır is based on a systematic method that incorporates rules ensuring modularity, flexibility, and the preservation of its traditional form. This process involves arranging components within a defined set of rules, ensuring their integration coherently and functionally. These rules serve as spatial constraints and parametric relationships that govern the modular organization, dimensional alignment, and hierarchical assembly of components. Shaped by the principles of RBD, Karaçadır not only serves as a physical shelter but also facilitates the materialization of the intangible heritage of Yörük culture at both spatial and structural levels. These foundational rule sets are visualized sequentially in Figure 4.4 (Rules 1–4).

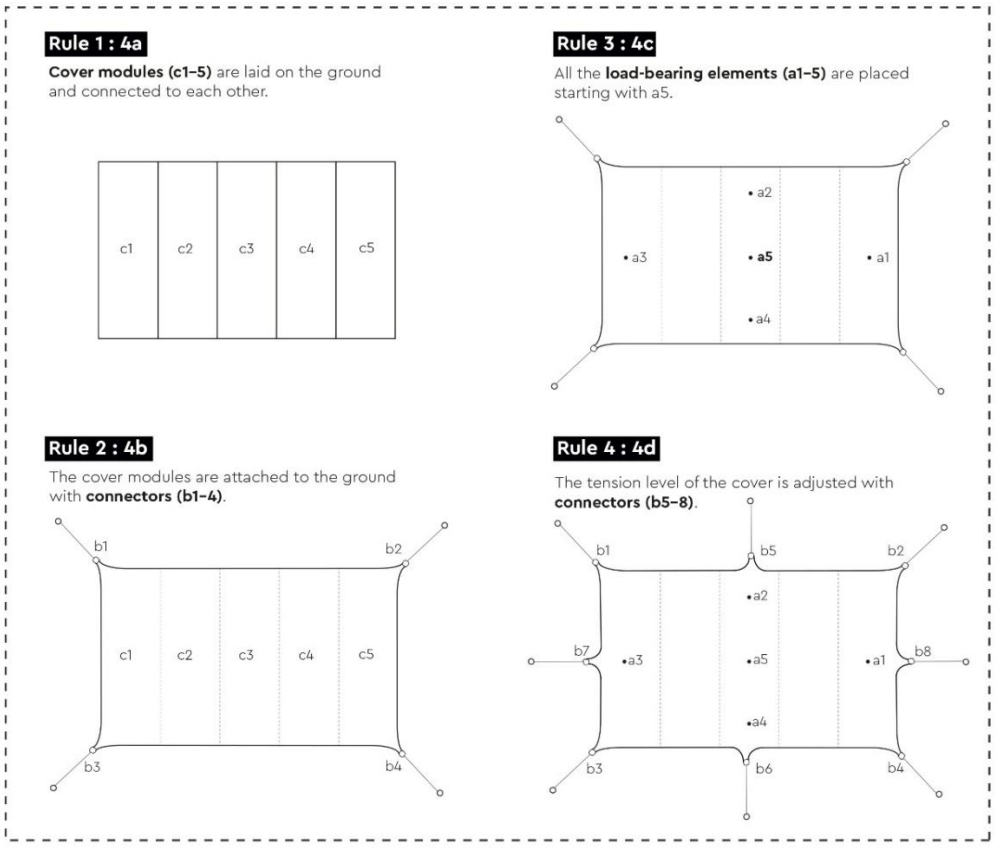

Figure 4.4: Diagrammatic making rules of Karaçadır (Source: Uçar and Gürer, 2025).

As the first rule, the cover modules (c1–c5) are laid out on the ground to ensure proper alignment. This step is crucial as it enables the correct positioning of modular components, providing structural integrity and surface continuity during the assembly

process. Subsequently, the modules are connected to form a homogeneous and continuous cover surface. The quantities and proportions of cover modules adhere to the principles of modularity and hierarchical organization, which are fundamental to the RBD approach. This layout logic corresponds to Rule 1 (Figure 4.4(a)). It can be interpreted as a form of vernacular production grammar, wherein each module's role and positioning follows culturally embedded but computationally expressible rules.

As the second rule, the structure is anchored to the ground using connectors b1, b2, b3, and b4. This rule enhances Karaçadır's resistance to environmental loads and dynamic forces by establishing a secure ground connection. The modular nature of the connection system allows Karaçadır to be both portable and reconfigurable, making it an adaptive design solution capable of meeting diverse spatial needs. This stage corresponds to Rule 2 (Figure 4.4(b)) and reflects a constraint logic derived from vernacular mobility practices.

As the third rule, the load-bearing elements (a1-5) are positioned. Beginning with a5, this placement process optimizes mass and structural balance, regulates load distribution, and ensures spatial stability. The systematic organization of these components, aligned with rule-based design principles, enables Karaçadır to be constructed and reproduced as a modular structure. This corresponds to Rule 3 (Figure 4.4(c)), where vernacular design intelligence is formalized into generative positioning logic.

As the fourth rule, b5, b6, b7, and b8 connectors are integrated, and the tension of the cover is carefully adjusted. The even distribution of tensile forces prevents sagging and structural deformations, ensuring the long-term stability of the tent. This process exemplifies the intersection of traditional architectural knowledge with engineering principles, demonstrating how inherited construction techniques align with systematic design methodologies. It is formalized as Rule 4 (Figure 4.4(d)), completing the operational sequence embedded in the RBD layer.

The making rules of Karaçadır, as presented, allow the implicit VAK of Yörük culture to be materialized through a systematic design principle, RBD. The rules set and organizational principles embedded in rulebased design not only facilitate the construction of a physical structure but also enable the preservation and transmission of a knowledge system across generations. In this context, Karaçadır is not merely a

shelter; it functions as spatial memory and a cultural design methodology, embodying both tangible and intangible aspects of Yörük architectural heritage. These rule-based operations are not only descriptive but operationalized as constraints and parameters that inform the genetic algorithm. In this way, RBD serves as a critical bridge between vernacular logic and computational design methodology.

4.3.3 VAK+RBD+GAs: Abstracting rules for integrating VAK into GAs

Building upon the rule sets formalized in Section 3.2, this section introduces the generative design process. The RBD framework provides the foundational design intelligence derived from VAK; however, these rules cannot be transferred into the GA system in their raw form. As such, an intermediate operation of abstraction is introduced, translating culturally embedded construction logic into a notation system. In this way, the generative process remains grounded in the vernacular RBD logic of the Karaçadır while also becoming computable. The abstraction layer thus serves as an operational bridge, allowing for a seamless transition from spatial rules to generative variations without compromising cultural coherence.

Based on this abstraction layer, each component of the Karaçadır is encoded using a notation system that is deliberately simplified to support algorithmic operations. The symbols used in the notation system not only represent architectural components but also reveal the spatial and structural logic of the Karaçadır through their positional arrangement. Cover modules (c1–c5), which define the tensile surfaces, are represented by horizontal continuous lines (–). These lines express the linear and modular organization of the tensile surface, indicating how it unfolds and extends across space. Load-bearing elements (a1–a5), which ensure the structural stability of the Karaçadır and distribute loads within the supporting system, are depicted by circular symbols (O). These symbols mark the main anchoring points where structural forces are transmitted to the ground. Connectors (b1–b8), represented by X-shaped markers, define the joints and relational points between cover and load-bearing components. These intersections correspond to the modular construction logic often observed in vernacular building practices (Figure 4.5).

This spatial arrangement plays a significant role in digitally translating the intuitive spatial organization observed in traditional construction logic. Thus, the symbols function not merely as visual codes, but as structural elements that express decisions

related to site interaction, construction strategy, and spatial flow. To clarify this translation process, Figure 4.5 also illustrates how these elements (–), (O), and (X) are abstracted and encoded as genotypic inputs within the GA framework. This step bridges the RBD layer with the computational logic of the algorithm, enabling the generation of culturally coherent variations.

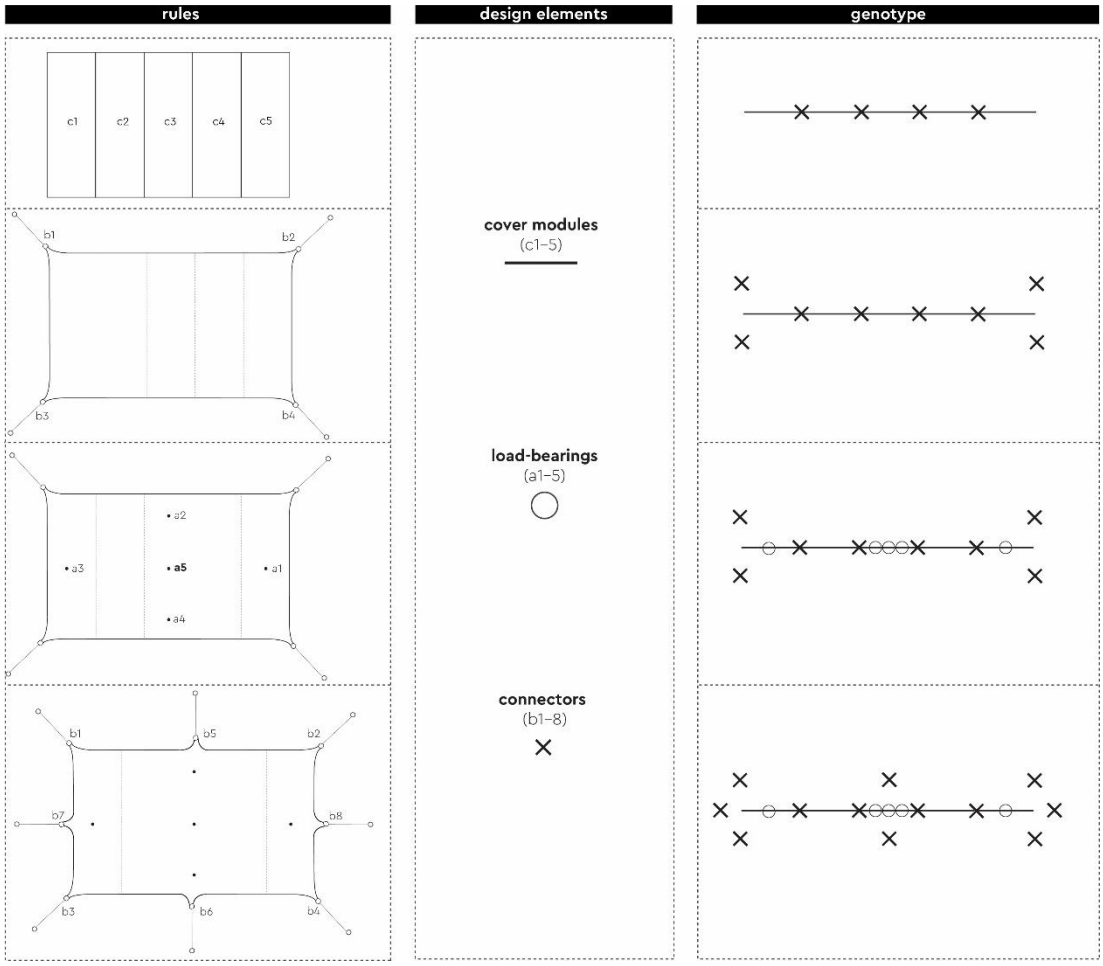

Figure 4.5: Abstracting rules for integrating VAK into GAs (Source: Uçar and Gürer, 2025).

As these rules are abstracted into a notation system, they enable the generation of distinct physical configurations, resulting in variations within the two-dimensional Karaçadır typology. These variations illustrate the adaptive intelligence embedded in the Karaçadır, which has historically evolved in response to environmental constants, material availability, and socio-cultural requirements. By structuring this knowledge within a computational framework, GAs facilitate an evolutionary exploration of architectural variations, enabling the iterative optimization of structural modularity.

The process of revealing the RBD logic embedded in the Karaçadır and subsequently abstracting it into a notation system enables the systematic integration of VAK into

GAs. This approach demonstrates the typically implicit nature of VAK through explicit rules, which are then subjected to an abstraction operation that translates them into a notation compatible with genetic algorithms. In doing so, RBD functions as an intermediary layer between vernacular knowledge and algorithmic operations, preserving cultural intelligence while facilitating generative exploration.

4.4 Implementation of VAK-based GA model

4.4.1 Flowchart

The study presents the design elements of Karaçadır, the rule-based logic embedded within them, and the abstraction process through which these rules are translated into a computable system, within the context of a case study on the discovery of plan layout variations (Figure 4.6).

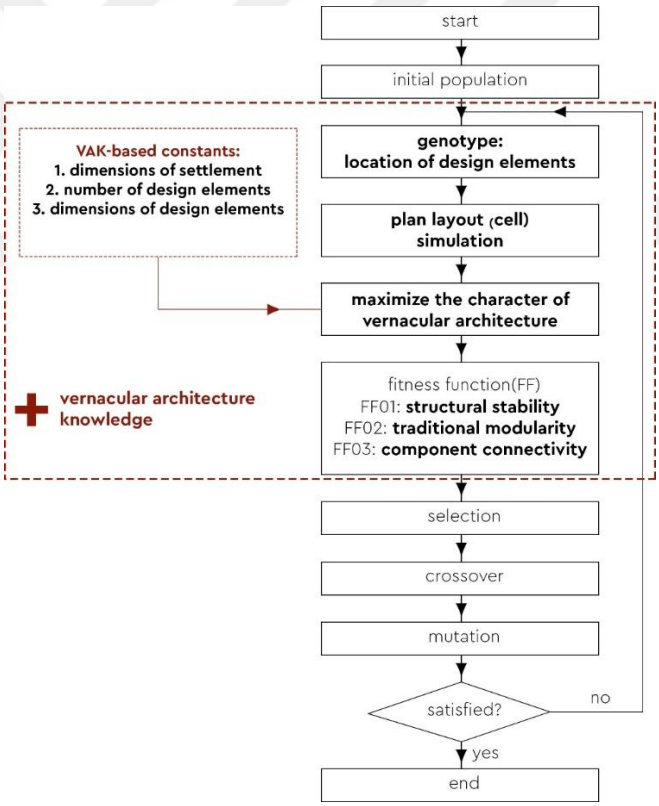

Figure 4.6: Genetic algorithm flowchart with VAK-based constants (Source: Uçar and Gürer, 2025).

In this regard, the aim is to reveal the impact of the VAK and RBD background on the algorithm before generating design variations using Genetic Algorithms (GAs). Therefore, in addition to the design parameters typically found in conventional GAs, the study aims to incorporate the design constants identified through the VAK+RBD

approaches. By integrating these design constants into the algorithm, three objectives are pursued: (1) minimizing the number of suboptimum design variations, thereby (2) reducing computational load and processing time, and (3) generating variations that, as a result of all preliminary studies and background research, maximize the character of vernacular architecture. For this case study, the design platform utilizes Rhino/Grasshopper software tools, while the genetic algorithm (GA) tool employed is Galapagos.

4.4.2 Model setup

In this study, a simplified yet representative case study is conducted to validate the influence of the predefined vernacular architectural knowledge (VAK) constants within the framework of genetic algorithms (GAs). The placement area is structured as a 10×10 grid, consisting of 100 equally spaced cells, each measuring 50 cm × 50 cm. This unit measurement is derived from on-site studies, which identify 50 cm as the minimum modular width of Karaçadır covers. By preserving this measurement, the GA ensures that all generated design variations remain within the traditional dimensional constants of Karaçadır.

Unlike three-dimensional modeling approaches, this study employs a two-dimensional plan-based representation, where structural components are depicted using a notation system. These notations serve as genotypic markers (2D), facilitating the systematic encoding and evolutionary optimization of design configurations. Once generated, each genotype is translated back into its phenotypic (3D) representation, ensuring alignment with vernacular architectural principles. This plan-based representational strategy also draws directly from the embedded vernacular logic of the Karaçadır. In traditional practice, the components of the Karaçadır are first laid out on the ground during the construction process, with the dimensional and positional relationships among elements determining the accuracy and stability of the eventual threedimensional structure. Thus, working with two-dimensional representations allows the generative system to encode not only the formal characteristics of the Karaçadır but also the culturally embedded spatial reasoning and assembly knowledge inherent in vernacular practices. To further validate this two-dimensional representational strategy, generations are presented together with their corresponding three-dimensional configurations in the figures. These integrated representations

demonstrate that the plan-based logic reliably produces spatial outcomes that are both structurally feasible and culturally grounded.

The GA operates within a structured framework of predefined maximum and minimum thresholds for each design element, which are not arbitrarily assigned but are rather extracted through a systematic typological analysis of Karaçadır structures. These constants do not merely regulate the design space; rather, they constitute the explicit codification of VAK, encapsulating the inherent spatial logic and construction principles of Karaçadır.

The number of load-bearing elements, which directly influences structural stability (fitness function 1), is constrained within the range $3 \leq O \leq 8$, ensuring that the emergent configurations align with the balance between material economy and structural sufficiency observed in traditional Karaçadır setups. The number of cover modules follows a range of $2 \leq - \leq 7$, a limitation that preserves the conventional modularity (fitness function (2) and assembly techniques of Karaçadır covers, maintaining their adaptability to different spatial requirements. The number of connectors is set within $4 \leq X \leq 10$, ensuring component connectivity (fitness function (3) so that the structure remains both flexible and resilient, adhering to the principles of dynamic tensioning that allow Karaçadır to respond effectively to environmental forces.

These constants do not merely serve as computational boundaries but rather embody the architectural intelligence embedded in the VAK. By formalizing this knowledge into quantifiable parameters, the GA does not impose external design criteria; instead, it translates the spatial and structural intelligence of Karaçadır into a computationally operable framework. This approach ensures that the optimization process remains rooted in VAK principles, allowing for evolutionary variations that are not only structurally viable but also culturally and typologically consistent with the knowledge system embedded in traditional Karaçadır design.

Figure 4.7 illustrates a possible spatial distribution of the design elements within the structured 10×10 placement matrix, where the gray grid defines the spatial framework, establishing the parametric boundaries within which the optimization process unfolds (Figure 4.7). The modular cover elements, represented by blue lines (–) (c1–c5), are not placed independently within the grid; instead, each cover module is positioned

adjacent to another, aligning with the edge of a neighboring cell rather than being distributed in isolation. This sequential placement strategy ensures continuity within the covering system, reflecting the traditional modularity of Karaçadır, where fabric modules are systematically connected to form an integrated shelter.

In contrast, the placement of load-bearing elements and connectors follows a structurally strategic differentiation. The load-bearing elements, marked by black circles (O) (a1-a3), are deliberately positioned at the junctions where multiple cover modules meet, ensuring that the structural support system aligns with the primary stress points of the interconnected cover network. This placement reinforces the tensile and load distribution mechanisms inherent in Karaçadır construction. The connectors, indicated by red cross (X) (b1-b6), follow a distinct placement rule: rather than being positioned directly at the cover module intersections,they are placed one cell apart from the nearest cover module junction, introducing a deliberate gap that enhances the structural flexibility of the system. This offset arrangement maintains the dynamic tensile balance of the structure, ensuring that the system remains adaptable to environmental forces while preserving overall cohesion (Figure 4.7).

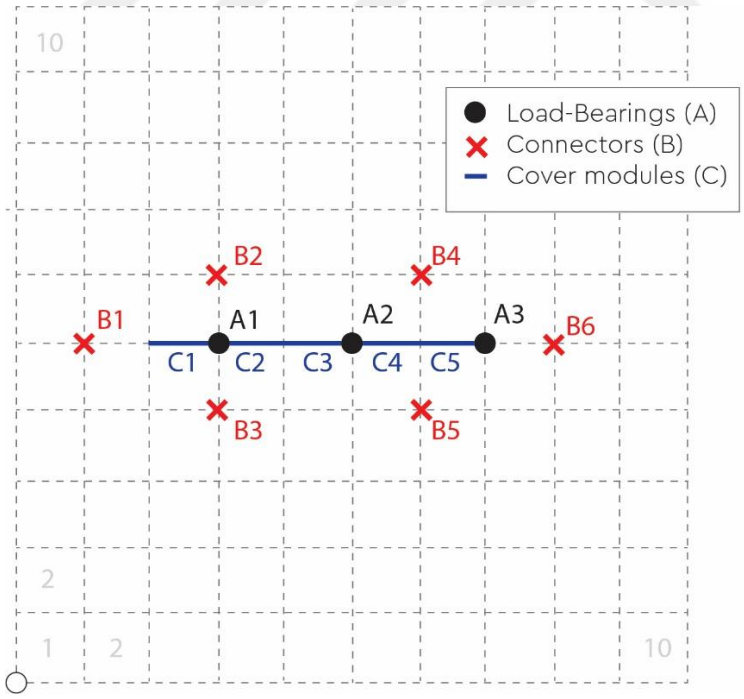

Figure 4.7: Possible spatial distribution of Karaçadır design elements (Source: Uçar and Gürer, 2025).

Within this spatial setup, positioning of these components emerges as a governing parameter in the optimization process, dictating how VAK principles of Karaçadır are

systematically encoded and evolved within the genetic algorithm framework. The explicit adjacency constants of cover modules, the strategic junction-based placement of load-bearing elements, and the offset positioning of connectors collectively shape the computational search space, refining the optimization process by eliminating arbitrary spatial permutations and steering the evolutionary algorithm toward structurally and culturally coherent solutions.

The spatial organization depicted in Figure 4.7 maintains the delicate balance between VAK and algorithmic optimization, embodying the interaction between predefined typological constants and dynamic parameter variations. In this way, the generated configurations are shaped within a system that is structurally stable, prioritizes the connections of components that define the vernacular architectural character, and ensures the preservation of this character.

4.4.3 Fitness functions

The fitness function (FF) in this study is designed to evaluate and optimize the Karaçadır structures using VAK within a GA framework. The primary goal of this FF is to guide the optimization process by integrating predefined architectural constants that ensure structural integrity, modularity, and cultural fidelity. The FF determines the effectiveness of a generated Karaçadır variation based on multiple criteria derived from RBD and VAK principles. These criteria ensure that the generated designs maintain structural stability through load-bearing efficiency, preserve traditionalm modularity by adhering to the historical making logic of Karaçadır, and establish component connectivity through the proper integration of cover modules, connectors, and load-bearing elements (Figure 4.8).

In this study, these operations are performed by a genetic algorithm guided by multiple fitness functions and formulated as follows (4.1).

$$F = w_1 + w_2 + w_3 \tag{4.1}$$

Fitness function 1 (FF01) - S represents structural stability, evaluated based on the even distribution of load-bearing elements and the structural tension of the covering system (Figure 4.9(a)).

Fitness function 2 (FF02) – T represents traditional modularity, ensuring that the generated design adheres to traditional Karaçadır making rules (Figure 4.9(b)).

Fitness function 3 (FF03) - C represents component connectivity, ensuring proper spatial and structural relationships between elements (Figure 4.9(c)).

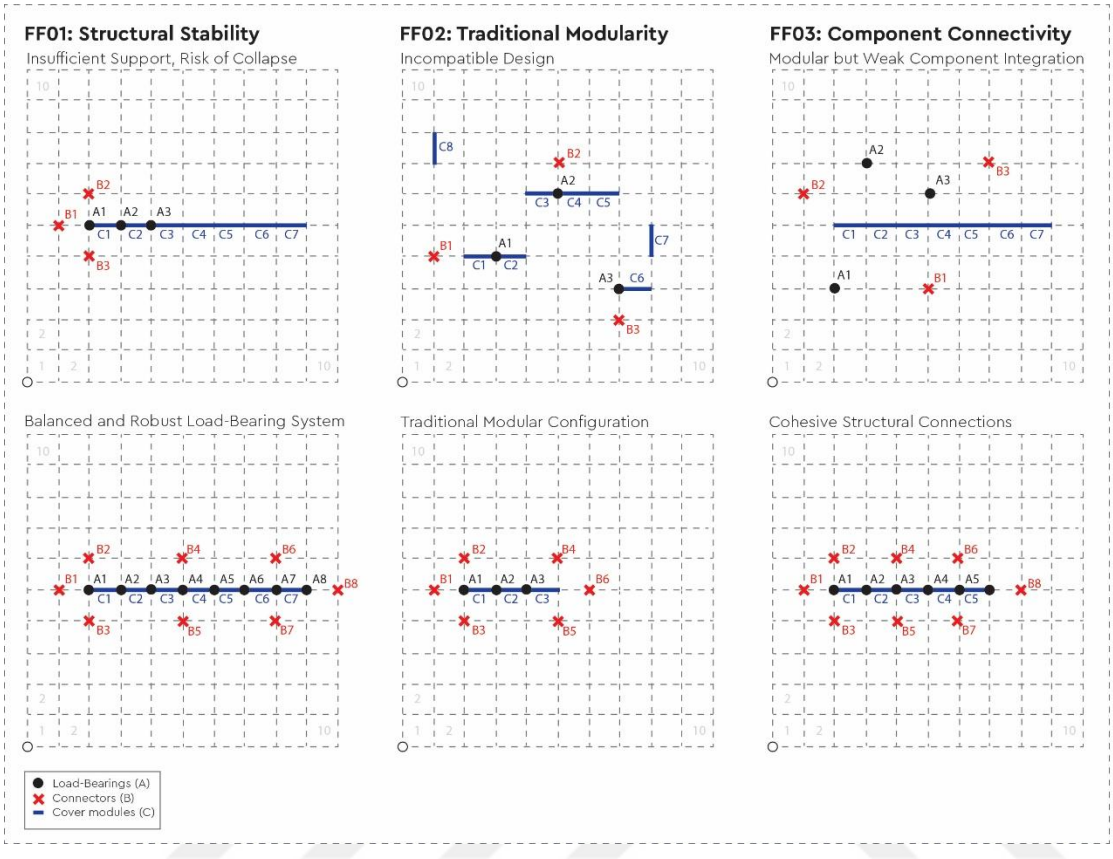

Figure 4.8: Schematic explanation of fitness functions (Source: Uçar and Gürer, 2025).

As seen in Equation 4.1, the coefficients w_1, w_2, and w_3 are dynamically adjusted based on their relative importance in the optimization process. These values ensure that the generated designs are both structurally efficient and culturally coherent while maintaining meaningful architectural configurations.

4.4.4 Algorithmic model outcomes

The model employs a GA–based iterative process to generate and refine Karaçadır configurations. This approach prevents premature convergence and ensures the sustainability of a dynamic search space. The evaluation and reproduction cycle proceeds iteratively until a predefined convergence criterion is met. The algorithm terminates when any of the following conditions is satisfied: (1) the average fitness score stabilizes over 10 consecutive generations, (2) no significant structural improvement is observed across iterations, or (3) a maximum of 50 generations is reached. Each design is represented as a 10×10 grid-based genotype composed of

cover modules, load-bearing elements, and connectors. This structure allows for genetic variation while maintaining modular consistency. The evaluation process is guided by three predefined fitness functions: structural stability (FF01), traditional modularity (FF02), and component connectivity (FF03) (Figure 4.9).

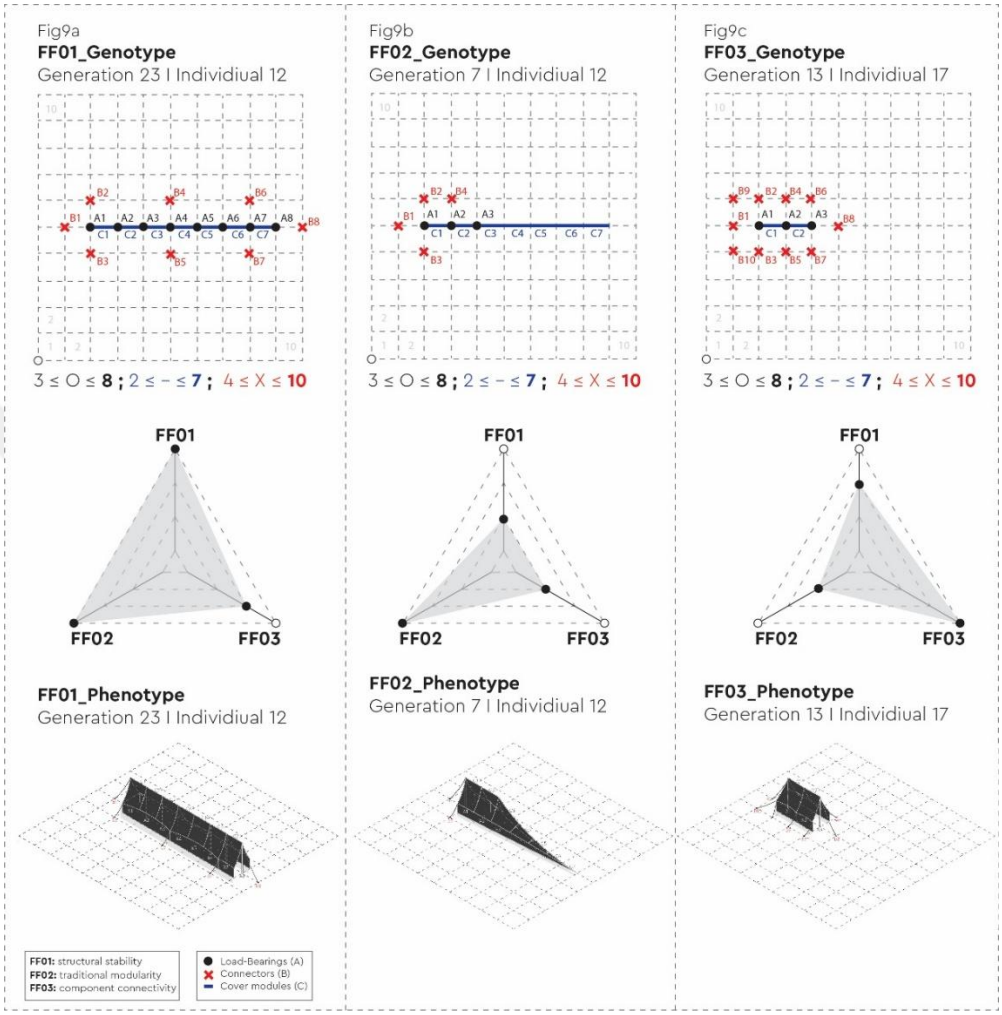

Figure 4.9: The optimized solutions evolved according to a single fitness function (Source: Uçar and Gürer, 2025).

The configuration optimized for structural stability (FF01) (Figure 4.9(a)) shows a dense arrangement of load-bearing elements (A) placed at key structural junctions primarily the edges and intersections of cover modules (C). This strategy leads to high FF01 scores and, by reinforcing structural logic, also elevates FF02 values. However, FF03 remains lower, suggesting that increased component count alone does not guarantee connectivity or efficiency. The algorithm's emphasis on load-bearing reinforcement reflects a prioritization of stability over interconnectivity. The resulting form demonstrates how strategic placement, rather than sheer quantity, drives structural optimization.

The configuration optimized for traditional modularity (FF02) (Figure 4.9(b)) emphasizes a regular,repeatable layout with a linear arrangement of cover modules (C) and minimal use of load-bearing elements (A) and connectors (B). This results in high FF02 scores, reflecting a design strategy rooted in modular selfcontainment rather than structural reinforcement or dense connectivity. While still an early-stage output, the configuration demonstrates the algorithm's capacity to explore adaptable, lightweight forms suited to mobile architectural typologies.

The configuration optimized for component connectivity (FF03) (Figure 4.9(c)) prioritizes interconnectivity over structural or modular logic. A high concentration of connectors (B) ensures that all elements remain linked, yet the sparse placement of load-bearing elements (A) compromises structural stability. This trade-off illustrates the algorithm's tendency to favor continuous linkage at the expense of architectural coherence. As a result, while FF03 scores are maximized, the configuration lacks the spatial and structural clarity seen in more balanced solutions.

The configurations individually optimized for FF01, FF02, and FF03 reveal the distinct design implications of each fitness criterion, while also exposing the inherent limitations of single-objective approaches. Although each solution performs well in relation to its targeted objective, it exhibits various shortcomings with respect to the other criteria. This indicates that architectural coherence cannot be achieved through a single parameter alone and underscores the need for multi-objective optimization to generate more balanced outcomes. Therefore, optimization processes that simultaneously evaluate multiple criteria gain significance in achieving more holistic and coherent design solutions (Figure 4.10).

Figure 4.10 presents two configurations resulting from multi-objective optimization, demonstrating how the algorithm balances structural stability (FF01), modularity (FF02), and connectivity (FF03). Despite differences in generation and component count, both solutions achieve comparable optimization values. Their varied spatial arrangements reveal the algorithm's capacity to explore structurally diverse yet culturally coherent outcomes, aligning with vernacular architectural principles. The visual comparison highlights how performance can be maintained through either dense or minimal compositions, underscoring the adaptability of the Karaçadır typology. The comparison between dense and minimal configurations underscores the modular logic of the Karaçadır, where similar optimization outcomes can emerge from structurally

distinct solutions. This adaptability reflects the scalability and robustness of the typology within the genetic algorithm framework.

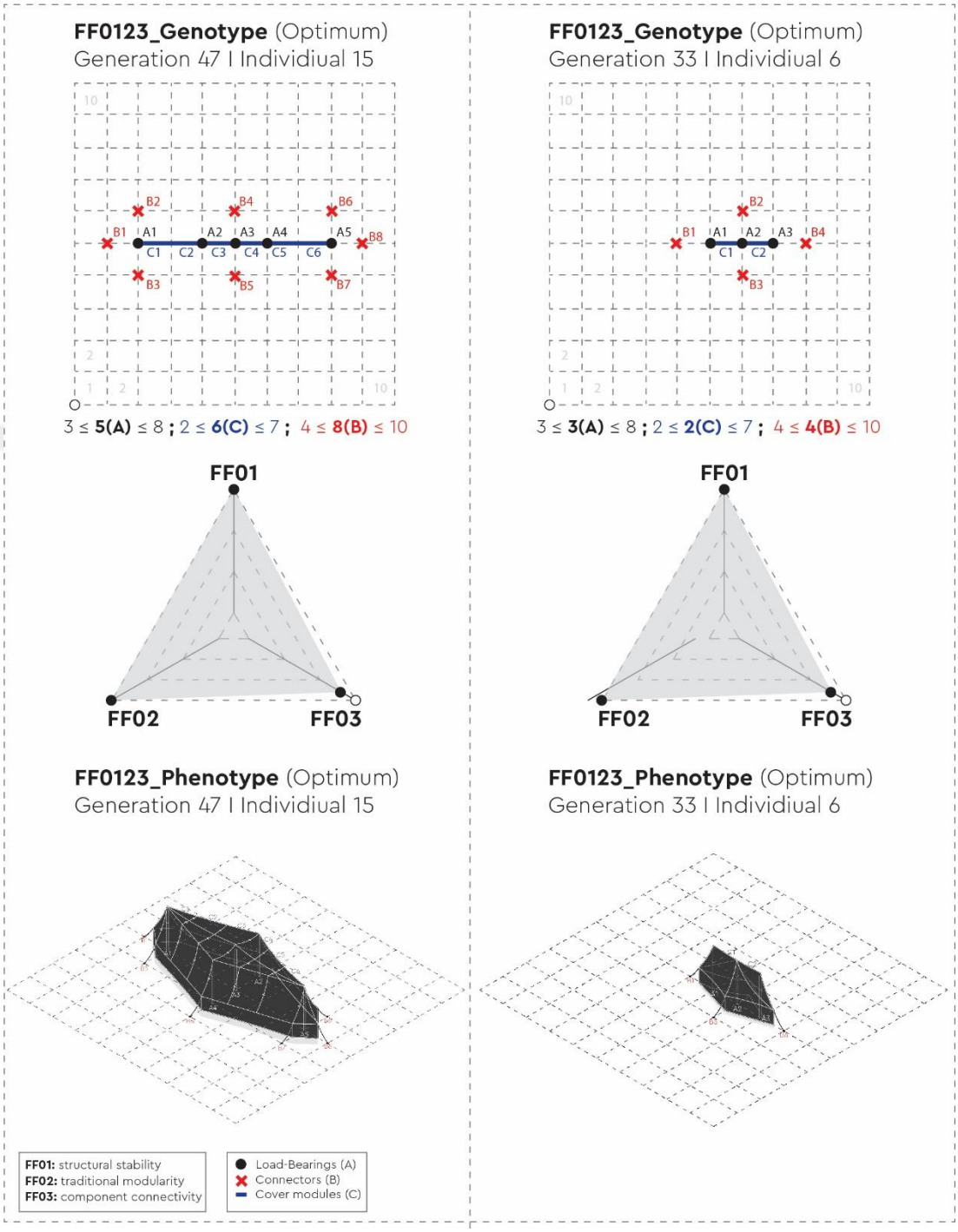

Figure 4.10: The optimum solutions evolved according to all fitness functions (Source: Uçar and Gürer, 2025).

Beyond numerical performance, structural arrangements convey cultural meaning. FF01-driven outputs-with densely placed load-bearing elements-align with traditional Karaçadır logics designed for long-term, family-oriented use. In contrast, FF02 outputs reflect lightweight, mobile shelters suited for short-term occupation by smaller groups.

FF03 outputs, while maximizing interconnectivity, lack spatial coherence and cultural recognizability, revealing the outer limits of what constitutes a vernacularly valid configuration. Notably, the design that most closely aligns with traditional Karaçadır principles is not necessarily the computationally optimal result. This highlights a critical insight: cultural fidelity and algorithmic efficiency do not always converge.

Building on this insight, there emerges a need to develop generative systems notmerely as tools for producing formal variations, but as frameworks capable of integrating local knowledge and cultural continuity into algorithmic processes. Indeed, the integration of vernacular rules into genetic algorithms enables an evolutionary transition from disorganized and inefficient early generations to modular, coherent, and structurally optimized configurations with fewer components (Figure 4.11).

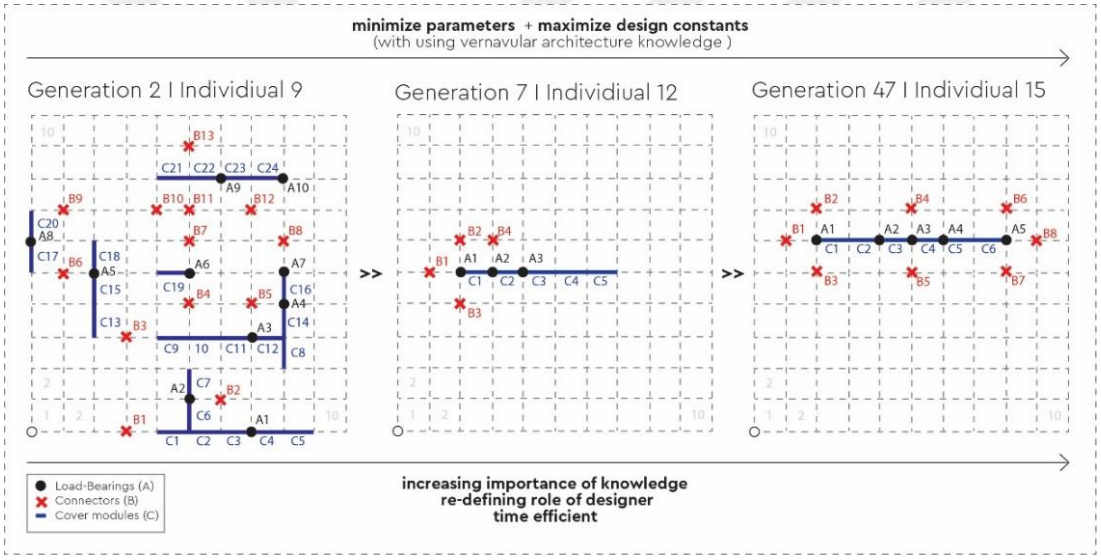

Figure 4.11: Optimization process of GAs with VAK-based constants (Source: Uçar and Gürer, 2025).

This process not only facilitates variation but also reduces redundancy, reinforcing the modular and scalable nature of the Karaçadır typology. As a result, this approach advances a culturally informed generative design paradigm and offers a transferable, sustainable, and contextually meaningful framework applicable to other vernacular architectural typologies.

4.5 Conclusion and Discussion

This study aims to explore how intangible cultural heritage can be integrated into computational design processes through genetic algorithms (GAs). Taking the

Karaçadır-an architectural structure belonging to Yörük nomadic culture-as a case study, it investigates how vernacular architectural knowledge (VAK) can be operationalized and embedded within generative algorithms. The findings demonstrate that this integration not only improves formal optimization but also enables the production of contextually consistent design variations that maintain cultural continuity. In addition, they reveal a key insight: cultural coherence in design is not a guaranteed outcome of algorithmic optimization alone; it is made possible through the embedded intelligence of vernacular knowledge.

Accordingly, the results of the VAK-based GA optimization developed within the scope of this study demonstrate that the model is capable of generating multiple Karaçadır variations, effectively enhancing structural stability, traditional modularity, and component connectivity. By minimizing suboptimal design variations and reducing computational load, the computational process offers a more efficient optimization framework and yields configurations that align with traditional Karaçadır typologies. This confirms that embedding vernacular logic within the optimization process not only improves performance but also safeguards typological identity throughout generative iterations.

In addition, a comprehensive set of parameters was established to generate a diverse range of design variations. However, when these variations were produced without incorporating VAK constants, the results significantly deviated from optimal solutions, rendering complete optimization impractical-even in this simplified case study. The integration of VAK constants into the design optimization process substantially reduced both computational time and the number of redundant variations. This suggests that cultural knowledge, when formalized as design constants, serves not only as a memory of tradition but as an active filter guiding the generative process toward coherence and efficiency. Within this context, the VAK parameters-identified as design constants by the designer-were pre-established as vernacular knowledge prior to the execution of the GA optimization process. Consequently, even when the generated solutions may be considered part of intangible cultural heritage, they remained anchored within their historical and contextual framework. These findings produced by the algorithmic model also reinforce the contributions of the proposed VAK–RBD–GA tripartite methodological approach.

The methodological approach adopted in the study demonstrates how vernacular design intelligence can be translated into a generative system through the Karaçadır case study. A clear contrast is established between the method constructed through rules derived from preliminary research on VAK and a contextindependent approach to generating design variations. This contrast is formalized through a three-stage framework: the extraction of rule-based design (RBD) logic from VAK, its abstraction into a notation system, and its integration into GAs. Within this structure, RBD functions as a critical intermediary that translates culturally embedded spatial principles into a computable format without detaching them from their original context. By positioning RBD as both a methodological and epistemological bridge, the study offers a transferable approach between vernacular and computational domains, revealing the methodological adaptability of the proposed framework across different design contexts.

In addition to its conceptual and methodological contributions, the study also highlights a representational strategy for encoding vernacular knowledge.Within the scope of the research, the use of a two-dimensional, plan-based representation is not merely a pragmatic modeling decision, but a deliberate alignment with the spatial logic inherent in the Karaçadır. In vernacular practice, the components of the Karaçadır are laid out on the ground prior to assembly, and their dimensional and positional relationships guide the accuracy and success of the final structure. This process reflects a cultural model of spatial reasoning that is inherently planar in nature. This insight reinforces that computational representations can-and should-mirror vernacular construction logic, not overwrite it. Accordingly, the generative system developed in this study adopts a representational logic that is not only computationally tractable, but also epistemologically consistent with the vernacular system it seeks to encode. In this case, it is not the computational model that shapes the structure, but rather the vernacular logic itself. To further validate this approach, the twodimensional variations are presented alongside their corresponding three-dimensional configurations, demonstrating that the planar logic reliably produces spatial outcomes that are structurally feasible, contextually grounded, and culturally coherent. This formal alignment sets the stage for a deeper insight: the interpretive role of the designer.

This study emphasizes that cultural coherence is not an automatic consequence of computational optimization. The solution that most reflects traditional Karaçadır principles is not the one that is mathematically the fittest, but the one that emerges through the careful framing of constraints grounded in vernacular knowledge. This observation highlights the importance of the designer's interpretive agency- not merely in configuring parameters, but also in preserving the cultural significance embedded within spatial systems. In this light, the generative model becomes more than a mechanism for producing variation; it transforms into a reflective interface where architectural memory, design intuition, and algorithmic reasoning converge. Such a framework does not replace vernacular logic with computation; on the contrary, it channels it-reconfiguring tradition as a living, computationally operable design intelligence.

In this regard, the contribution of the study goes beyond merely proposing a new model; it also reveals how this model resonates with core theoretical discussions in contemporary computational design discourse. Specifically, the study frames the design space not as an abstract field of formal permutations, but as a culturally situated domain shaped by vernacular logic. Through the integration of VAK constants with rules, the generative system optimizes a meaningful and bounded design space in which variations emerge not from arbitrary combinations, but from culturally structured parameters. This approach aligns with current debates on cultural encoding in algorithms, as the model embeds vernacular knowledge not as symbolic references, but as operational rules that govern the system's behavior.

Ultimately, the algorithmic model developed in this study produces outputs that are typologically coherent, contextually grounded, and architecturally meaningful. Furthermore, the model exemplifies a constraint-driven creativity framework, where constraints derived from cultural logics are not limitations but productive drivers of design emergence. Within this framework, vernacular knowledge functions not as a static referent, but as an active and effective source of variation, adaptation, and optimization. In this regard, the study not only positions vernacular knowledge as both a conceptual and computational foundation, but also develops an original approach that mediates between inherited spatial intelligence and evolving algorithmic paradigms-redefining generative design as a reflective and future-oriented practice that critically engages with culturally embedded design knowledge.

5. CONCLUSION

Building upon the historical and epistemic trajectory outlined at the outset of this thesis, in which mobility-based modes of spatial knowledge were gradually supplanted by sedentary, stabilized, and standardized systems, this study reconsiders mobility as a latent form of design intelligence. Mobility-based cultures are increasingly at risk of being reduced to static representations, stripped of the very dynamics that once sustained them. When practices grounded in movement, adaptation, and relational space are confined to descriptive accounts alone, they risk becoming little more than markers of what once existed, almost as an empty epitaph. In response to this condition, the thesis approaches culture not as a vanishing object to be preserved, but as a living and productive knowledge system capable of informing contemporary design thinking. Accordingly, it develops a translational framework that seeks to reveal, structure, and reactivate mobility-based knowledge within computational design processes.

In doing so, the study challenges design paradigms that privilege permanence, standardization, and singular epistemologies. Rather than treating mobility-based cultures as peripheral historical cases or symbolic heritage references, the thesis positions them as carriers of alternative design intelligences capable of contributing to contemporary design discourse. In this sense, the research aligns with a plural understanding of design knowledge, one that recognizes multiple situated ways of making, dwelling, and world-forming rather than assuming a singular universal design logic.

This thesis concludes with the identification and transformation of four mobility-based design phenomena, namely cell, provision, transition, and nomad, derived from the spatio-temporal practices of Yörük culture. These phenomena are not introduced as predefined analytical categories. Instead, they are revealed through a phenomenological inquiry as emergent patterns embedded within lived experience, as articulated in the first publication, *"Unveiling Nomadic Utopias: Phenomenological*

Insights into the Spatio-Temporality of Yörük Culture". In this sense, phenomenology operates as a necessary precondition for the subsequent phases of the research, nabling culturally grounded design intelligence to become analytically legible prior to any form of abstraction or formalization.

The significance of this process lies in the fact that not all revealed phenomena are equally translatable into computational logic. While phenomenological investigation allows these patterns to be articulated, a critical step of the research involves identifying which of these phenomena possess computable characteristics. This distinction establishes a selectively permeable boundary between experiential knowledge and generative design processes.

Within this framework, the phenomena of transition, provision, and nomad are interpreted as relational and process-oriented structures that operate across spatial transformations. These are systematically examined in the second publication, *"A Heritage Ecosystem in Motion: Yörük Spatial Practices and the Ecology of Mobility",* where they are translated into a visual grammar capable of articulating dynamic spatial relationships and rules. In contrast, the phenomenon of cell, which operates at the scale of the architectural unit and exhibits modular and parametric properties, is identified as particularly suitable for computational translation. This leads to its further development in the third publication, *"Integrating Vernacular Architectural Knowledge into Genetic Algorithms: A Case Study on Karaçadır",* where it is reformulated as a set of generative design parameters.

The central question that follows concerns how these selected and differentiated phenomena can be translated, structured, and ultimately regenerated within contemporary design frameworks. In this sense, the thesis does not treat these phenomena as descriptive outcomes. Instead, it positions them as operative units of design intelligence that can be systematized and extended beyond their original cultural context.

This transformation, which extends from emergent phenomena to generative design logic, does not occur instantaneously but unfolds through a sequence of methodological translations. Each stage of the research repositions these phenomena within a different representational and analytical framework, progressively shifting them from experiential constructs to operational design entities. Accordingly, the

structure of the thesis reflects a cumulative process through which mobility-based knowledge is revealed, structured, and ultimately regenerated.

Within this cumulative trajectory, the research unfolds as a continuous process in which different phases address distinct yet interrelated dimensions of mobility-based design knowledge derived from Yörük culture. Operating across varying scales, methods, and analytical frameworks, these phases are unified by a shared conceptual logic centered on revealing, systematizing, and generating mobility-based intangible heritage.

5.1 Synthetic Evaluation of the Three Publications

While each of the three publications constituting this thesis addresses a distinct research question and operates at a different analytical scale, their primary strength lies in their deliberate interdependence.

The first publication operates at the scale of human experience and is primarily concerned with epistemic access. Its central question is how mobility is lived, perceived, and negotiated in everyday life. By foregrounding temporality, rhythm, and transition, this study establishes the conditions under which design knowledge can be revealed without being prematurely abstracted. As the initial phase of the research trajectory, its output is not a system or a model, but an interpretative understanding of mobility as a generative condition. Without this phase, the research would risk systematizing patterns whose experiential meaning remained unexamined, thereby reducing mobility to a formal attribute rather than a lived reality.

The second publication shifts scale from experience to spatial organization, translating phenomenological insights into analyzable structures. Building upon the first study, which establishes interpretative depth, the second emphasizes structure, relational logic, and representational clarity. The introduction of a visual grammar marks a methodological transition from revealing to systematizing. In this progression, the publication operates as a hinge between qualitative insight and formal reasoning. If the first study provides epistemic grounding, the second provides methodological articulation. Without this phase, the research would remain descriptive and experiential, lacking the capacity to communicate, transfer, and operationalize mobility-based spatial knowledge within design-oriented frameworks.

The third publication introduces a further shift in scale, from space to objects and generative processes, and from analysis to production. In contrast to the first two studies, which focus on understanding existing practices, the third actively engages with design generation. By integrating vernacular knowledge into genetic algorithms, this publication demonstrates that the previously revealed and systematized knowledge can function within computational design environments. As the final phase of the research trajectory, it represents a test of translational validity. It asks whether culturally embedded principles can survive abstraction and still produce meaningful outcomes. Without this phase, the thesis would remain analytically strong but design-wise incomplete, stopping short of demonstrating how mobility-based heritage can actively contribute to contemporary design practice.

Across the three publications, a clear progression can be observed in terms of knowledge type. The first study produces experiential and tacit knowledge, the second converts this knowledge into structured and explicit systems, and the third mobilizes these systems for generative use. This progression is neither incidental nor interchangeable. Each publication addresses a limitation inherent in the previous one. Phenomenological insight alone cannot be transferred without systematization; systematization without generation risks remaining archival; generation without experiential grounding risks cultural detachment. Their synthesis thus reveals a carefully constructed epistemic chain rather than a collection of independent studies.

The publications also differ in their methodological commitments, yet these differences are complementary rather than contradictory. Phenomenology prioritizes situated understanding, visual grammar emphasizes relational abstraction, and computational design foregrounds formal logic and rule-based production. Taken together, these methods form a layered approach to design research that moves from interpretation to representation and finally to generation. This methodological diversity strengthens the thesis by preventing overreliance on a single epistemological stance and by allowing each phase to address questions appropriate to its scale and purpose.

Across the three publications, different forms of limitation are addressed and strategically negotiated. The first is bounded by contextual specificity, the second by the interpretative selectivity required for systematization, and the third by computational scope. However, when considered as part of a sequential research

trajectory, these limitations are mitigated through their interdependence. Contextual depth feeds abstraction, abstraction enables computation, and computation tests the resilience of cultural knowledge under transformation. This structured progression ensures that limitations do not accumulate but instead inform and balance one another.

Ultimately, this synthesis demonstrates that the thesis does not propose three alternative readings of mobility-based design knowledge, but a single, integrated research trajectory articulated through three necessary phases. The publications are not interchangeable, nor could any one of them stand alone as a complete representation of the research agenda. Their integration confirms that the strength of the thesis lies in its ability to move coherently across scales, methods, and knowledge forms, establishing mobility as a design intelligence that can be revealed, systematized, and generated without losing its cultural grounding.

5.2 The Overall Contributions of the Thesis: Theoretical, Methodological, and Design-Oriented

Taken as a whole, this doctoral thesis makes a set of interrelated contributions that extend across theoretical, methodological, and design-oriented domains. The study introduces a comprehensive framework for engaging with mobility-based intangible heritage as a source of design knowledge. Its primary contribution lies in demonstrating how culturally embedded, experiential, and often tacit knowledge can be systematically revealed, structured, and reactivated within contemporary design discourse without being reduced to formal imitation or symbolic reference.

At the theoretical level, the thesis reframes mobility as a foundational condition of design knowledge rather than as a contextual constraint or logistical necessity. In contrast to dominant design paradigms that privilege permanence, stability, and fixed spatial organization, this research positions mobility as an epistemic driver that shapes how space is conceived, inhabited, and transformed. By doing so, the thesis also engages with broader debates concerning the politics of design knowledge, questioning which forms of intelligence become visible, legitimate, and transferable within dominant design discourse. The study argues that mobility-based cultural knowledge should not be understood as a marginal or residual tradition, but as part of a plural design landscape capable of informing future-oriented design thinking. By grounding this argument in Yörük culture, the thesis challenges static interpretations

of vernacular architecture and nomadic life, presenting them instead as dynamic knowledge systems capable of informing contemporary design thinking.

Another key theoretical contribution lies in the articulation of the human experience–space–object triad as an integrated framework for understanding cultural production. Rather than treating experience, space, and objects as separate analytical categories, the thesis demonstrates how they operate as mutually constitutive layers of design intelligence. Mobility emerges not as an attribute of any single layer but as a relational condition that connects bodily experience, spatial organization, and material adaptation. This tripartite perspective offers an alternative to object-centered or form-driven design theories by foregrounding process, transformation, and relationality.

The thesis also contributes to ongoing debates on intangible cultural heritage by expanding its scope beyond preservation and representation. Instead of framing intangible heritage as knowledge to be safeguarded in archival form, the study conceptualizes it as an active and generative resource. By doing so, it aligns heritage discourse with design research, positioning cultural knowledge as a living system capable of producing new meanings and forms.

Methodologically, the thesis offers a distinctive research model that integrates phenomenology, visual grammar, and computational design within a single coherent framework. This integration constitutes a major contribution to design research, particularly in contexts where cultural knowledge is experiential, embodied, and resistant to direct formalization. The sequential structure of revealing, systematizing, and generating enables the transformation of tacit knowledge into explicit, transferable, and productive design intelligence.

The phenomenological phase contributes a rigorous approach to uncovering tacit knowledge without prematurely translating it into abstract categories. By prioritizing lived experience, temporality, and situated practices, the research avoids the risk of reducing cultural phenomena to surface-level representations. This methodological stance reinforces the importance of interpretation and reflexivity in design research, particularly when engaging with culturally embedded knowledge systems.

The visual grammar framework introduced in the second phase represents a methodological innovation that bridges qualitative insight and formal representation. Unlike typological or diagrammatic approaches that tend to fix spatial configurations,

the grammar captures relational logic and transformation rules. This enables mobility-based spatial knowledge to be documented and communicated while preserving its adaptability. The grammar functions as an analytical and generative tool, capable of operating across different scales and contexts.

The final phase extends this methodology into the realm of computational design, demonstrating how culturally grounded rules can be translated into algorithmic logic. By integrating vernacular knowledge into genetic algorithms, the thesis challenges the assumption that computational design is inherently detached from cultural context. Instead, it shows that computation can function as a mediating interface through which cultural knowledge is structured, tested, and reconfigured. Methodologically, this establishes a pathway for integrating qualitative cultural research with quantitative and rule-based design systems.

From a design-oriented perspective, the thesis provides a framework for engaging with cultural heritage that moves beyond stylistic borrowing or symbolic reference. The grammar of mobility developed through the study enables designers to work with underlying principles rather than fixed forms. This approach supports the generation of new design variations that remain culturally grounded while being responsive to contemporary conditions and requirements.

By focusing on adaptability, modularity, and transformation, the research offers design strategies that are particularly relevant to current challenges such as environmental uncertainty, temporary habitation, and resource efficiency. The emphasis on mobility-based design principles resonates with broader discussions on resilience and sustainability, positioning vernacular knowledge as a source of innovation.

Importantly, the thesis demonstrates that engaging with local knowledge systems does not limit design creativity. On the contrary, it expands the design space by introducing alternative logics of organization, material use, and spatial negotiation. The generated design explorations are not presented as final products but as evidence of the generative capacity of the proposed framework. In this sense, the contribution of the thesis lies less in specific design outcomes than in the design thinking it enables.

Overall, the thesis contributes a multi-layered and transferable model for engaging with mobility-based intangible heritage in design research and practice. Its theoretical contribution lies in redefining mobility as a design intelligence, its methodological

contribution in offering a structured yet flexible research framework, and its design-oriented contribution in enabling culturally grounded generative processes. Together, these contributions position the study as a bridge between cultural heritage research and contemporary design innovation, demonstrating that local, experiential knowledge systems can actively shape future-oriented design practices.

5.3 Applicability of the Tripartite Framework in Other Contexts

The tripartite framework developed in this thesis, structured around revealing, systematizing, and generating mobility-based design knowledge is proposed as a transferable research logic that can be adapted to other cultural and spatial contexts in which design knowledge is embedded in lived experience, spatial practice, and material adaptation. The flexiblity of this framework lies in its capacity to engage with culturally grounded knowledge systems through a sequential and scalable methodology.

At its core, the framework is designed to operate in contexts where knowledge is predominantly tacit, experiential, and distributed across practices. Many local, vernacular, and community-based cultures share this characteristic, particularly those shaped by environmental uncertainty, seasonal rhythms, or resource constraints. In such contexts, design intelligence often emerges through repeated actions, adaptive strategies, and negotiated relationships between people, spaces, and objects. The revealing phase of the framework, grounded in phenomenological inquiry, offers a means of accessing this knowledge without forcing it prematurely into abstract or formal categories. This makes the approach applicable to a wide range of mobility-based and non-static cultural settings beyond the Yörük case.

The systematizing phase further enhances the framework's transferability by providing a method for translating experiential insights into relational structures. Visual grammar, as employed in this thesis, does not depend on culturally specific symbols or stylistic codes. Instead, it focuses on identifying patterns, rules, and relationships that govern transformation and adaptation. This relational emphasis allows the method to be recalibrated for different spatial and cultural conditions. For instance, temporary fishing settlements, seasonal agricultural communities, informal urban occupations, or disaster-response housing systems may exhibit distinct spatial logics, yet all involve recurrent transitions, adaptive arrangements, and negotiated boundaries. In such cases,

a visual grammar approach can be used to articulate how spatial systems operate without fixing them into static typologies.

The generative phase of the framework further supports its applicability by demonstrating how systematized cultural knowledge can inform contemporary design processes. By translating visual grammar rules into computational or rule-based design systems, the framework enables culturally embedded principles to be reactivated rather than merely documented. This is particularly relevant in contexts where design must respond to change, uncertainty, or temporary conditions. The use of computational thinking as a mediating interface allows designers to test how culturally grounded rules behave under new constraints, scales, or material conditions. While the specific computational techniques employed in this thesis are tailored to the Karaçadır case, the underlying logic of rule-based generation can be adapted to different object types, spatial systems, and cultural settings.

At the same time, the framework's applicability is not universal in a reductive sense. Its transfer depends on contextual interpretation and methodological recalibration. The phenomenological phase, in particular, requires close engagement with local practices and cannot be bypassed without undermining the framework's integrity. Applying the model to another context without adequately revealing experiential knowledge would risk producing superficial systematizations detached from lived reality. Similarly, the systematizing and generating phases must be informed by context-specific values, constraints, and priorities rather than imposed as generic design tools.

Importantly, the framework prescribes a logical progression of knowledge transformation. In some contexts, spatial systematization may precede object-based analysis, or generative exploration may take non-computational forms. The strength of the tripartite structure lies in its flexibility and its emphasis on epistemic continuity. This allows the framework to accommodate diverse cultural logics while maintaining a coherent research trajectory.

In this sense, the Yörük case functions as a demonstrative example. It shows how mobility-based intangible heritage can be engaged as an active source of design knowledge when appropriate methods are employed. The broader implication is that culturally embedded knowledge systems, whether nomadic, semi-nomadic, or situationally mobile, can be brought into dialogue with contemporary design practice

without being reduced to stylistic references. The tripartite framework thus offers a viable pathway for extending design research beyond dominant paradigms of permanence and standardization, opening space for alternative design intelligences grounded in movement, adaptation, and relational thinking.

5.4 Yörük Insights: Experiential and Field-Based Reflections

Revisiting Yörük camps after the completion of the analytical phases of this research provided an opportunity to reflect on the findings of the study not only from an academic standpoint, but also through dialogue with those whose daily practices constituted its foundation. While this thesis does not claim to be based on participatory validation in a formal methodological sense, returning to the field functioned as a form of experiential cross-checking. Sharing the conceptual interpretations, spatial readings, and object-based analyses with Yörük families enabled a grounded reflection on whether the revealed, systematized, and generated knowledge resonated with lived realities.

One of the most striking confirmations emerging from these encounters was the emphasis placed by Yörük participants on adaptability. When discussing spatial arrangements or object configurations, attention was rarely directed toward fixed layouts or predefined structures. Instead, conversations repeatedly returned to questions of timing, weather, terrain, livestock behavior, and collective decision making. This emphasis closely aligns with the thesis's framing of mobility as a temporal and relational condition. The interpretations developed in the phenomenological phase were often met with practical narratives that reinforced the centrality of rhythm, anticipation, and situational adjustment in everyday life.

When spatial analyses and visual grammar representations were informally discussed, the responses suggested a recognition of relationships rather than representations. Rather than engaging with diagrams as abstract models, Yörük participants tended to interpret them through memories of specific moments, such as setting up camp, rearranging living areas, or responding to sudden environmental changes. This reaction underscores a critical insight. For Yörük communities, space is not experienced as a stable configuration but as a sequence of negotiated actions. The visual grammar, in this sense, appears to resonate not as a depiction of space itself, but as an articulation of how space comes into being through practice. This reinforces the

validity of systematizing spatial knowledge through relationships and transitions rather than through static typologies.

Discussions surrounding objects, particularly the Karaçadır and associated elements, further highlighted the embedded logic of mobility-based design. Conversations frequently emphasized ease of assembly, repairability, and the ability to modify components in response to changing needs. These insights align directly with the design parameters identified in the generative phase of the research, such as modularity, multifunctionality, and material efficiency. Notably, these characteristics were rarely described as deliberate design choices. Instead, they were presented as natural responses shaped by experience and necessity. This observation reinforces one of the thesis's central claims, that mobility-based design knowledge emerges through accumulated practice.

Another important insight gained through these reflections concerns the role of collective knowledge. Decisions related to space and objects were often described as shared and negotiated rather than individually authored. This collective dimension challenges conventional design narratives that emphasize authorship and intentionality. It suggests that mobility-based design intelligence is distributed across social relations and reinforced through repetition and shared memory. The thesis's emphasis on grammar rather than authorship gains particular relevance in this context. The grammar of mobility does not attribute design outcomes to individual creativity but to a shared system of relations that evolves over time.

These field-based reflections also revealed a degree of skepticism toward permanence and optimization. Fixed solutions, rigid structures, or overly specialized objects were often described as liabilities rather than advantages. This perspective resonates strongly with the thesis's critique of static design paradigms and reinforces the relevance of mobility-based principles in contemporary contexts characterized by uncertainty and change. The Yörük emphasis on reversibility, adaptability, and minimal dependency on fixed infrastructures provides a powerful counterpoint to dominant design logics rooted in permanence and efficiency.

Ultimately, these final encounters with Yörük communities did not function as validation in a technical sense, but as a reflective mirror through which the research could be reconsidered. The conversations suggested that the interpretations developed

throughout the thesis did not distort or over-intellectualize lived practices, but rather articulated relationships that were already operative, albeit unspoken. This alignment between analytical abstraction and experiential reality strengthens the epistemic grounding of the study and affirms the ethical stance of engaging with cultural knowledge as something to be interpreted with care rather than extracted or formalized without context.

Through these reflections, the thesis returns to its point of departure. Mobility-based design knowledge cannot be fully captured, fixed, or owned, precisely because it remains situational, adaptive, and relational. The contribution of this research therefore lies not in converting Yörük life into universal design prescriptions, but in constructing a mediating framework through which culturally situated knowledge can be interpreted, translated, and reactivated with methodological care. In this sense, the thesis argues for a more plural understanding of design intelligence, one that recognizes alternative ways of knowing, making, and inhabiting the world as active contributors to contemporary design futures.

5.5 Limitations of the Study

While this doctoral thesis offers a comprehensive framework for revealing, systematizing, and generating mobility-based design knowledge, it is shaped by a series of methodological, contextual, and scope-related limitations. Recognizing these limitations is essential for situating the contributions of the study and identifying directions for further development.

One primary limitation concerns the scope and duration of field engagement. Although the research draws on direct encounters, observations, and experiential insights from Yörük communities, it does not constitute a long-term ethnographic study based on sustained participant observation. The phenomenological approach adopted in the first phase prioritizes depth of interpretation over longitudinal coverage. While this enables the articulation of tacit and experiential knowledge, it limits the capacity to account for variations across different Yörük groups, regions, and seasonal cycles.

A second limitation relates to the selective focus on specific spatial and object-based cases. The systematization phase concentrates on particular transitional moments and spatial configurations, while the generative phase centers on the Karaçadır as a

representative object. These choices ensure analytical clarity and methodological coherence, yet they constrain the breadth of applicability demonstrated within the thesis.

The computational dimension of the study introduces further limitations. While the integration of vernacular knowledge into genetic algorithms demonstrates the generative potential of the proposed framework, the computational models remain exploratory. The generated outputs are not evaluated through physical prototyping, performance simulation, or user-based testing, and therefore function primarily as proofs of concept rather than validated design solutions.

A key methodological condition of the study concerns the selective abstraction required to translate tacit cultural knowledge into analytical and computational frameworks. This process does not constitute an unintended methodological shortcoming, but a necessary interpretative operation through which situated experiential knowledge becomes representable, transferable, and generatively operable. Nevertheless, such translation inevitably leaves certain affective, embodied, and situational dimensions beyond formal capture. The visual grammar and computational rules therefore should be understood not as exhaustive representations of lived cultural complexity, but as partial and purposeful mediations.

Taken together, these limitations define the epistemological and methodological boundaries of the research. Rather than diminishing its validity, they clarify the scope within which the proposed framework operates.

5.6 Directions for Future Research

Building upon these limitations, the study opens several theoretical and methodological directions for further research. First, the scope of field engagement may be extended through long-term and comparative studies across different Yörük groups, regions, and seasonal cycles. Such research would provide a more comprehensive understanding of how mobility-based design knowledge evolves across time, geography, and socio-economic conditions.

Second, the framework may be expanded beyond the specific cases examined in this thesis. Incorporating additional object types, tools, and infrastructural elements associated with Yörük life could reveal further layers of mobility-based design

intelligence. Similarly, examining a wider range of temporary and semi-permanent spatial configurations would enrich the visual grammar and test its adaptability under diverse conditions.

Third, the computational phase may be further developed toward applied design contexts. Future studies could integrate fabrication processes, material experimentation, environmental performance analysis, or user-based evaluation. Such extensions would strengthen the connection between cultural logic and implementable design outcomes. Fourth, future research may extend the framework by complementing abstraction-based modeling with hybrid methodological approaches. Combining formal modeling with narrative, performative, or participatory modes of representation could enable a closer engagement with the experiential and embodied dimensions of cultural knowledge.

Finally, the broader applicability of the proposed framework invites comparative testing across different contexts. Applying the framework to other mobility-based or context-sensitive cultures, such as seasonal agricultural communities, coastal settlements, informal urban occupations, or post-disaster environments, would not only test its transferability but also reveal how different forms of mobility generate distinct design logics.

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PUBLICATIONS, PRESENTATIONS AND PATENTS ON THE THESIS:

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Book Chapters

- Gürer, E., & Uçar, U. E., (2023). Bedroom: A Phenomenological Probing for the Invisible. Unveiling Water's Implicit Journey in Domestic Interiors (pp.135-156), New York: NOVA Science Publishers Inc. ISBN:979-8-88697-769-1,

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Positions in Projects

- (2024), BAP Project, conducted under the supervision of Şehnaz Cenani Durmazoğlu, titled "Investigating the Impact of Virtual Reality Technology on the Spatial Awareness of Architecture and Interior Architecture Students," *(Researcher).*
- (2021-2023), TÜBİTAK 1001 Project coded 121M812, conducted under the supervision of Assoc. Prof. Dr. Seniye Banu Garip, titled "Konut İç Mekanlarında Deprem Risklerini Azaltmaya Yönelik Tasarım Kriterlerinin Belirlenmesi ve Azaltılmış Risk Alanlari Tanımlayan Bir Tasarım Modeli Geliştirilmesi," *(Scholar).*

Exhibition & Workshop

- 2019, International Master of Interior Architectural Design Workshop, Stuttgart, Almanya.
  https://www.schnittstelle-mensch-idee.de/wp-content/uploads/2019/07/IMIAD_entsesselt_2019_Programm_red-komprimiert.pdf
- 2022, "Red Carpet", Digital Representation Techniques in Interior Design exhibition, Taşkışla, İstanbul, Türkiye.
  https://www.arkitera.com/haber/red-carpet-istanbul-teknik-universitesi-ic-mimari-tasarim-uluslararasi-yuksek-lisans-programi-imiad-sergisi/

  https://www.arkiv.com.tr/proje/red-carpet/12319
- 2022, "See the Water", International Master of Interior Architectural Design Workshop, İstanbul, Türkiye.
  https://www.arkitera.com/haber/see-the-water-itu-ic-mimari-tasarim-uluslararasi-yuksek-lisans-programi-imiad-2022-yaz-calistayi/

  https://xxi.com.tr/i/baglam-uretme-platformu-olarak-sergi-mekani-see-the-water