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Marrakesh as a multisensory memory system: Atmosphere, Perception and the Architecture of Felt Space

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Abstract
There is a particular quality to arriving in Marrakech. Before the eye has time to process the geometry of the medina, the city communicates through other channels. The air carries the smell of cumin and charcoal. The call to prayer from the Koutoubia mosque overlaps with the hammering of coppersmiths in the Souk Haddadine. The light entering through the narrow openings between covered souk stalls is intense, and the shadow immediately adjacent is equally deep. The medina is difficult to navigate geometrically because of its dense and irregular street system, yet it remains strongly memorable for residents and visitors alike. This paper argues that this memorability comes less from spatial clarity and more from repeated sensory signals that help people orient themselves through material familiarity and accumulated experience.

This paper treats the historic medina of Marrakech as a sensory environment experienced from within rather than a formal urban plan read from above. Its central argument is that the medina functions as a multisensory memory system: a spatial field whose coherence depends not on geometric legibility, but on the layering of consistent atmospheric signals that accumulate in the body of the perceiver over time. The evidence is drawn from the specific material, olfactory, acoustic, and thermal conditions of the medina as documented in urban research, ethnographic studies, and heritage assessment.

Introduction

The theoretical frame draws on the phenomenology of architectural experience (Juhani Pallasmaa, Gernot Bohme), the humanistic geography of place and memory (Yi-Fu Tuan), and the field of sensory ethnography (Sarah Pink). These are brought into contact with the UNESCO World Heritage documentation of the medina and the urban grammar research by Duarte, Ducla-Soares, and Caldas. The paper also incorporates the work of Jorge Otero-Pailos on olfaction and historic preservation, which opens a practical dimension for thinking about how sensory traces are embedded in the material fabric of buildings and what it would mean to document and preserve them.

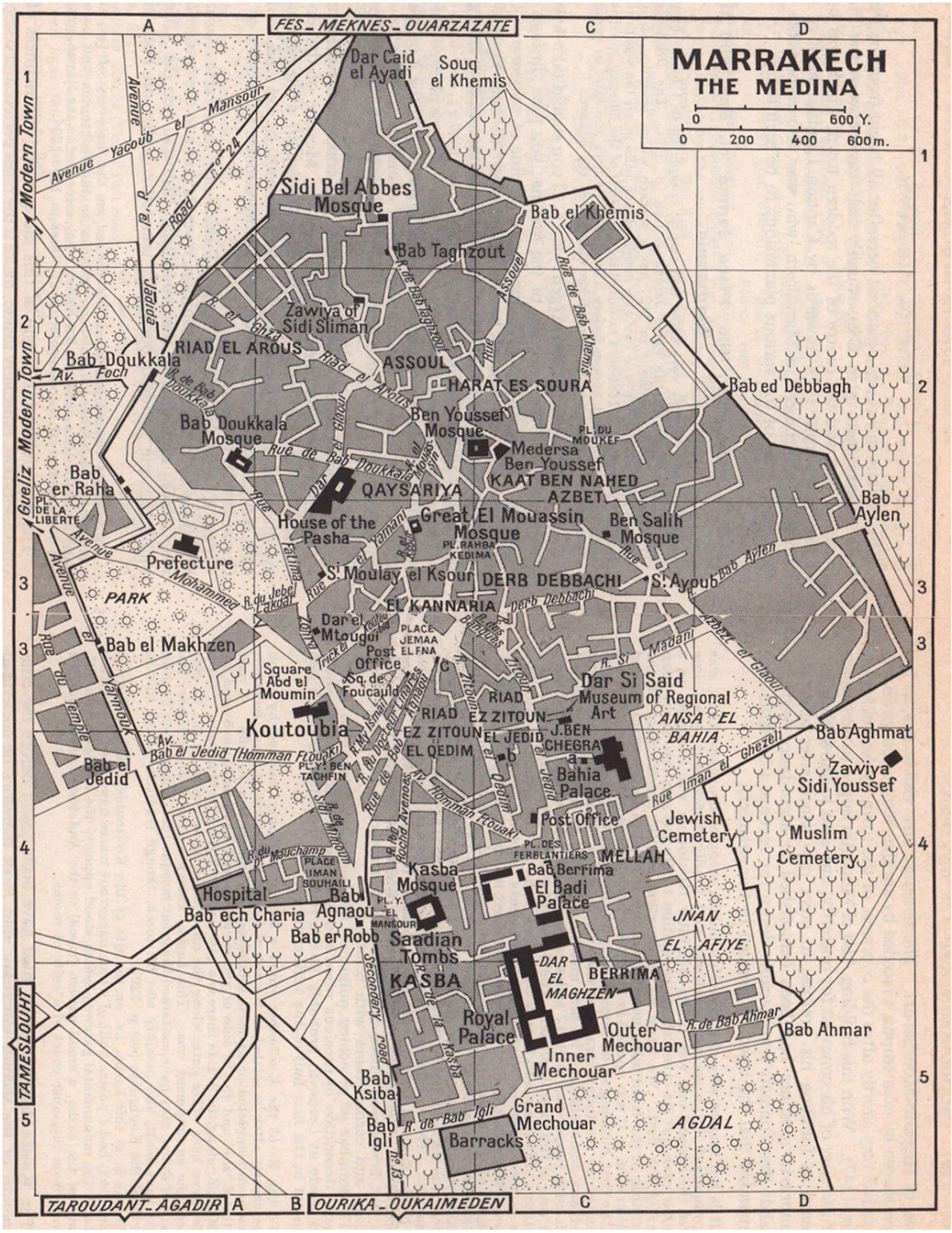

Fig. 1: Historic plan of the Medina of Marrakech. The dense, non-orthogonal street network of the central souk district is visible in the dark mass running north of Jemaa el-Fnaa (labeled Place Jemaa el-Fna, center). Streets bend, narrow, and dead-end without clear axes or visual terminations.

Fig. 2: Aerial view of the Marrakech medina at late afternoon. The uniform ochre-pink color field is produced by pisé (rammed earth) construction, the dominant building material of the medina, derived from iron-rich local soil. The Atlas Mountains are visible to the south.

The Visual Field: Material Consistency and the Pisé Palette

The dominant building material of the Marrakech medina is pisé, a form of rammed earth construction made from local soil mixed with lime and organic additives. The iron oxide content of the Haouz plain soil gives the material its characteristic ochre-pink color, which accounts for the city's popular designation as the Red City (Arabic: al-Hamra). This color is not applied as a finish but is intrinsic to the structural material. The 19-kilometer rampart wall, constructed primarily under the Almoravid dynasty in the 12th century, the street facades of the derbs, and the outer walls of mosques and madrasas all share this material. The result is a continuous visual field in which variation occurs at the level of surface treatment, light angle, and age of the plaster, but the underlying hue remains consistent across the entire medina.

Kevin Lynch, in The Image of the City, proposed that urban legibility depends on five identifiable elements: paths, edges, districts, nodes, and landmarks. The medina presents a direct challenge to this framework. The street network, as documented in the urban grammar study by Duarte, Ducla-Soares, and Caldas, follows an organic pattern of aggregation and subdivision organized around the derb system: a hierarchical network of public streets, semi-private lanes, and dead-end residential passages that prioritizes privacy and thermal management over visual orientation. Street width in the souk area typically ranges from 1.5 to 4 meters. Streets change direction frequently and share no common orientation. There are no diagonal connectors or clear axial routes through the medina.

The medina nonetheless does not produce disorientation in the distressing sense this spatial description might suggest. The medina provides a substitute for geometric orientation: a material

and atmospheric consistency that functions as continuous background information. The pisé color is everywhere. The carved stucco and zellige tilework that appear at thresholds, around fountain niches, and at the entries of significant buildings follow a limited vocabulary of geometric interlace patterns drawn from a consistent formal tradition. Juhani Pallasmaa, in The Eyes of the Skin, argues that architecture is most powerfully experienced through peripheral rather than focal vision: a diffuse awareness of space, material, light, and atmosphere that engages the whole body. The quality of light reflected from a roughcast lime-plastered surface at 4pm in July is physically different from the same surface at 9am or in February. The city produces a cycle of atmospheric states rather than a fixed visual image, and the body that inhabits it over time learns to read those states as temporal and spatial markers.

The Olfactory Map: Scent Zones and the Spatial Organization of the Souks

The olfactory environment of the Marrakech medina is structured and spatially consistent. The souk districts, which occupy the area north of Jemaa el-Fnaa between the Ben Youssef Mosque to the north and the Mouassine quarter to the west, are organized by trade type. This organization is documented in the UNESCO World Heritage nomination file, which notes that the souk system of Marrakech retains its historic structure of specialized commercial zones. The Souk el-Attarine (spice souk) produces a concentrated mixture of cumin, coriander, dried rose petals, and ras el hanout. The Chouara tannery district, accessible from the Bab ed-Debbagh gate on the eastern edge of the medina, is detectable by smell from several streets away due to the mordants used in the leather tanning process, including pigeon excrement used to soften hides, and plant-based dyes including saffron, indigo, and pomegranate rind.

This olfactory zoning is a direct product of the medina's spatial organization. The clustering of trades in dedicated souk zones, a feature of Islamic urban planning documented across the Maghreb, means that the smell map of the medina corresponds precisely to its economic geography. A person familiar with the medina can use the transition between olfactory zones as a navigational system. The shift from the smell of fresh bread near the communal ovens (ferran) of a residential derb to the smell of cedar sawdust in the Souk Cherratine indicates a spatial transition from the residential fabric to the artisan quarter as reliably as any visual landmark.

Jorge Otero-Pailos, in the editorial introduction to Smell and Preservation (co-authored with Adam Jasper, Future Anterior, Winter 2016), argues that olfaction is a major component of the experience of historic places and is directly involved in the formation and recall of architectural memory, yet receives essentially no attention in preservation practice. His experimental work with the National Trust for Historic Preservation involved the olfactory reconstruction of the Philip Johnson Glass House at three points in its history: 1949, 1959, and 1969. The reconstruction was based on archival research into building materials, their aging, and the activities that took place in the building. His conclusion is that the archive of a building is not only in its visible fabric but in the chemical residues that inhabit that fabric over time.

Applied to Marrakech, this framework raises a specific preservation concern. The Mapping Myths of the Medina study by Nancy Nabeel Aly Demerdash (MIT, 2009) documents how French colonial urbanism and subsequent tourism development have produced what she calls an Oriental brandscape: a commodified version of the medina's sensory environment oriented toward visitor expectations rather than resident practice. The introduction of synthetic rose-water perfume shops, international restaurant kitchens, and motorized vehicle exhaust into the historic street network constitutes a measurable alteration of the olfactory record of the medina. Arndt Graf's study of multisensory food practices in Marrakech further documents how domestic cooking within the residential quarters, including the preparation of harira soup and the use of argan oil at specific times of day, forms a distinct olfactory layer inseparable from the inhabited fabric of the city.

Fig. 3: Jemaa el-Fnaa at dusk, looking northwest toward the Koutoubia mosque minaret (77 meters, 12th century). The square measures approximately 200 by 150 meters. The food stalls visible in the foreground operate nightly from approximately 7pm, transforming the acoustic and olfactory character of the space from its daytime market function.

Jemaa el-Fnaa: Acoustic Environment and Intangible Heritage

Jemaa el-Fnaa is the central public square of the Marrakech medina, measuring approximately 200 meters east-west by 150 meters north-south. It was designated by UNESCO as a Masterpiece of the Oral and Intangible Heritage of Humanity in 2001, before its integration into the Intangible Cultural Heritage Convention in 2008, making it the first public space to receive this designation. The grounds were not architectural. The designation was made on the basis of the living practices that take place within it: the Halqa performance tradition in which storytellers (hlaykia), musicians, acrobats, and healers perform within standing circles of audience members, a practice documented continuously in Marrakech since at least the 16th century.

The acoustic character of Jemaa el-Fnaa in the evening is produced by the simultaneous operation of multiple independent sound sources across the open ground. Gnawa musicians use the guembri (a three-stringed bass lute) and metal castanets (qraqeb) alongside Amazigh folk musicians using the bendir frame drum, alongside storytellers performing in Darija (Moroccan Arabic) or Tachelhit. The absence of enclosing walls means that each sound source radiates freely, producing an overlapping acoustic field. The halqa format requires performers to project outward to an audience standing in a ring, a format dependent on open ground with no fixed seating or architectural enclosure. The spatial form of the square is therefore not incidental to the acoustic tradition but its necessary condition.

Gernot Bohme's concept of atmosphere, developed in Atmospheric Architectures, defines atmosphere

as a quality that is neither purely objective nor purely subjective but emerges from the interaction between the physical environment and the perceiver. Jemaa el-Fnaa at dusk is a specific and reproducible atmospheric event: cooking smoke from the food stalls, the overlapping acoustic sources, shifting light from gas lanterns against the fading sky, and the thermal change as the ground radiates stored heat upward after sunset combine to produce a sensory density that is consistent across seasons while remaining entirely dependent on human activity. The El-FnaVR virtual reality reconstruction of the square, developed for intangible cultural heritage documentation, acknowledges this by attempting temporal and acoustic reconstruction rather than static spatial modeling. Its limitations, specifically its inability to reproduce the olfactory and thermal dimensions of the space, illustrate why the sensory dimension of the medina resists conventional documentation.

Thermal and Haptic Space: Climate, Street Width, and the Riad Section

The medina of Marrakech was built in a semi-arid climate with summer temperatures regularly exceeding 38 degrees Celsius. Street widths in the residential derb network typically range from 1 to 2.5 meters. At these widths, opposing walls shade the street surface for most of the day. The souk streets are covered with pergolas of woven reeds (jrid) that filter direct solar radiation while allowing air movement. Mashrabiya screens on upper-floor windows reduce direct heat gain. These are not passive consequences of the spatial organization but active thermal strategies that have been documented in vernacular architecture scholarship as characteristic of medina planning across the Maghreb.

The urban grammar analysis by Duarte, Ducla-Soares, and Caldas identifies a spatial hierarchy moving from the public artery (tariq) through the semi-public lane (zuqaq) to the dead-end residential passage (derb) and finally to the riad courtyard. This is simultaneously a thermal gradient. Air temperature, acoustic intensity, and light level all change measurably across this sequence. The riad courtyard, with a central fountain producing evaporative cooling and high surrounding walls that trap cool night air, is the thermal endpoint of the sequence. Yi-Fu Tuan's concept of topophilia argues that attachment to place is rooted in the specific sensory qualities that a place repeatedly offers the body over time. The thermal relief of entering a riad courtyard from a sun-exposed street is a specific, repeatable, and physically registered experience. The body that has experienced this transition multiple times develops an expectation of it, and that expectation is part of the cognitive map of the city.

Sarah Pink's methodological work in Doing Sensory Ethnography proposes that research on built environments should engage the full range of sensory experience rather than privileging visual documentation. For the medina, this would mean supplementing conventional architectural drawing with temperature and humidity logs correlated with spatial position, and with records of pedestrian pace and pause, since slowing down in a cooler shaded passage is spatial data. These methods do not replace architectural drawing. They extend it to capture dimensions of spatial experience that drawings cannot record.

The Sensory Grammar of the Medina

The sensory registers examined above operate according to their own spatial logics but are not independent. In the medina of Marrakech, they reinforce each other systematically. The term sensory grammar is used here in deliberate dialogue with the urban grammar framework of Duarte and colleagues, who use grammar to describe the generative rules that produce the morphological structure of the medina's urban fabric. This paper proposes a parallel: a sensory grammar consisting of rules encoded in building practice and spatial organization that produces the sensory identity of the medina with the same consistency that the urban grammar produces its physical form.

The components of this sensory grammar are as follows. First, material consistency: pisé, lime plaster, cedar, and zellige across the entire medina produce a unified visual and haptic field. Second, climatic responsiveness: street and building organization reflecting centuries of heat management produces a predictable thermal gradient from open public space to enclosed courtyard. Third, trade zoning: geographic clustering of crafts in defined souk districts produces a spatially structured olfactory environment legible as a navigational system. Fourth, temporal performance: the muezzin's call five times daily from approximately 200 mosques within the medina, the nightly transformation of Jemaa el-Fnaa, and the weekly rhythms of the souks produce an acoustic structure in time that organizes experience across the day and week.

What this sensory grammar produces is a multisensory cognitive map stored not only in spatial memory but in bodily memory. Lynch's image of the city is primarily a visual-spatial construct built from paths, edges, and landmarks. The cognitive map of a medina resident includes the smell of the Chouara tanneries as a directional marker placing Bab ed-Debbagh to the east, the temperature drop at the threshold of the reed-covered souk as a boundary signal, and the acoustic range of the Koutoubia minaret as a location cue audible across the entire medina. These are not supplementary to spatial knowledge. They constitute it. The literary record of Marrakech reflects this: Yassin Adnan's Marrakech Noir and the novels of Mahi Binebine consistently use the smell, sound, and tactile character of specific streets to establish location and anchor memory, because spatial description alone is insufficient to represent the medina as a lived environment.

Conclusion

The medina of Marrakech does not conform to the models of urban legibility developed in modernist planning theory. Its street network is not legible in Lynch's terms. Its heritage value includes dimensions that cannot be captured in architectural drawings or photographic surveys. Its spatial coherence is produced not by a visible organizing principle but by the accumulated consistency of material choices, climatic adaptations, and land-use patterns across nine centuries of continuous inhabitation.

The concept of the multisensory memory system proposed in this paper names this mode of coherence. It draws on Pallasmaa's critique of ocularcentrism, Bohme's concept of atmosphere as a felt spatial quality, Tuan's humanistic geography of place and bodily memory, and Pink's sensory ethnographic methodology. Applied to the specific conditions of the Marrakech medina, these tools reveal that the city's memorability is a structural property produced by specific material conditions, spatial organizations, and patterns of use maintained across a long period.

The practical implication concerns preservation. If the sensory grammar of the Marrakech medina is a heritage resource, its documentation and preservation require methods beyond those currently standard in architectural conservation. The systematic mapping of olfactory zones, the acoustic recording of Jemaa el-Fnaa across different times and seasons, the measurement of thermal gradients through the sequence from public street to riad courtyard: these are practical tasks. Otero-Pailos's work demonstrates that sensory dimensions of built environments can be treated as material evidence and as objects of conservation practice. The World Heritage designation of the medina protects its physical form. Its sensory content requires additional and specific attention, before the pressures of tourism and urban change alter the conditions that produce it.

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