Visual Rules for Socio-Spatial Analysis: Inferring a Grammar of Use in an Inhabited Climat de France

Reglas visuales para un análisis socio-espacial: Infiriendo una gramática de uso en un Climat de France habitado

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Abstract

Climat de France, a modernist housing complex in Algiers, was built in the 1950s during the final years of French colonization. Over the years, its residents have modified the original design by the French architect Fernand Pouillon, based on use, lifestyles, and local resources. Utilizing archival and photographic documentation, videos, and interviews to identify, characterize, and classify the modifications on the outer façades, this paper infers visual rules as generative and formal tools to analyze the continuity and discontinuity between socio-cultural acts and idealized forms in mass-customized housing.

Keywords: user context, generative design, shape grammar, rehabilitation, modern heritage, global South

Resumen

Climat de France, un complejo de viviendas modernistas en Argel, fue construido durante los últimos años de la colonización francesa, en la década de 1950. A lo largo de los años, sus residentes han introducido algunas modificaciones al diseño original del arquitecto francés Fernand Pouillon, basados en el uso, los estilos de vida y los recursos locales. Utilizando documentación de archivo y fotográfica, vídeos y entrevistas para identificar, caracterizar y clasificar las modificaciones de las fachadas exteriores, este documento infiere reglas visuales como herramientas generativas y formales para analizar la continuidad y discontinuidad entre los actos socioculturales y las formas idealizadas en la personalización masiva de viviendas.

Palabras clave: contexto del usuario, diseño generativo, gramática de la forma, rehabilitación, patrimonio moderno, sur global.

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Introduction

Use brings about change in buildings, albeit within the limits of material capacities. Change can be more extensive in situations where the building is designed to be open to change or when there is a wide discrepancy between the intended design and the inhabitants' expectations. *Climat de France* (Figure 1) is one example of the latter; through the residents, the social, cultural, and material forces have transformed parts of the physical form envisioned by the designer and the colonial rule at the time.

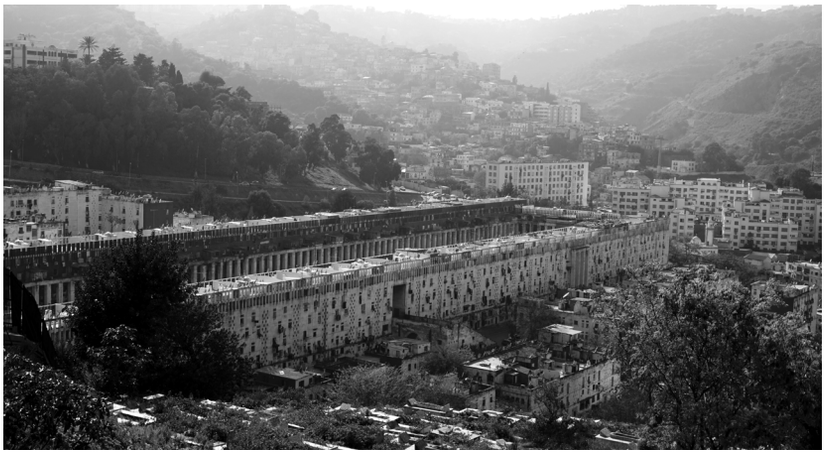


Figure 1. 200 Colonnes, the main courtyard building of Climat de France, which is the subject matter of our study (Photo credit: author, 2017).

Climat de France is a grand ensemble in Algeria: one of many that removed natives from the slums and put them into modern apartment life as part of the Colonial French rule's intense housing program. *Evolutif*[1] (scalable) apartments, which have modest sanitary facilities and a minimalistic spatial organization in the initial design, fell short in meeting the actual users' needs. Residents have been modifying the building ever since they moved in. Similarly to Le Corbusier's worker housing project *Pessac*, it is debatable whether *Climat de France* is successful as the "open system"[2] that its basic modular structure promotes or a failure because, as a "closed masterpiece" of clean-cut lines and repetitive minima, it was destined to be altered. Although *Climat de France* has architectural value in its own right as a sublime example of colonial modernism, additional value comes from its political charge and adaptation to an everyday use. Based on our motivation to study how the latter's transformative effect on the idealized design may inform sustainable reuse of existing structures in general, we focus on developing *other* methods of analyzing an inhabited space.

To rehabilitate existing buildings, there is a need for methodologies that look beyond the formal properties of architectural heritage, and understand it from within, with its anthropological and social factors, locality, and past use. Our visual computational approach is used to understand and lay bare some of the design values within *Climat de France*, both as an idealized design and a lived-in space. We seek a representation of the modifications with regards to the embodied experience and the deficiencies residents endure and address. This paper outlines how rules of a visual grammar of inhabited forms are uniquely inferred by incorporating social and historical factors along with visual evidence.

1. Jean Pelletier, "Un Aspect de l'Habitat à Alger: les Bidonvilles," *Revue de Geographie de Lyon* 30, no.3 (1955): 280.
2. Carlo Ratti and Matthew Claudel, *Open Source Architecture* (London: Thames & Hudson, 2015), 39.

The Design and User Contexts of Mass Housing

The incompatibility of mass housing projects and the residents who live various lifestyles within them is a prevalent discussion in architecture.[3] Studies as early as the 1960s sought ways to include potential residents in the design and construction process.[4] In material culture studies, home is a process as much as a thing, and the home and the people who dwell in it "accommodate" each other.[5] It is not only a place but also "a set of feelings/cultural meanings, and the relations between the two."[6] The creation of a home involves complexities, conflicts, and compromises from its inhabitants as dynamic individuals and social beings.[7] Dwelling, the lengthy process of making places and things that structure and house one's own activities, is an existential dimension of human life.[8] Ironically, modern dwelling takes part in the built environment where the dweller is often deemed a consumer and has little control over the process that creates the physical envelope.[9] In this case, both the home and its inhabitants transform through accommodation.[10] In mass housing, modifications are tools representing self-expression, and, often, destruction is the only self-expression tool left.[11] In *Climat de France*, façades manifest the making of homes in the historical and political context of modernism.

In the 1950s, CIAM (Congrès Internationaux d'Architecture Moderne) shifted their mass housing aspirations to vernacular and informal settlements in the global South.[12] As CIAM has a presence in South America through European urbanism and in North Africa through modern housing developments, the Italian and French protectorates saw North Africa as a vast land to test new design epistemes and projects.[13] The native residents of these projects, on the other hand, appropriated these colonial implementations into spaces for political action and independence.[14]

In 1953, CIAM Alger adopted a revolutionary but synoptic view of the culturally specific patterns of construction and inhabitation in a Mahieddine slum settlement.[15] Rather than looking at both the design and the user context,[16] projects displayed direct translations of cultural forms such as the patio, courtyard, or mashrabiya. These highlighted the gap between the description of the artifact based on the designer's preconditioned observations and projections, and the user's interpretation of it based on spatial experience. In our analysis of *Climat de France*, we develop an approach to incorporate user context with the usual focal subject of formal methods: the design context.

3. Nicholas John Habraken, *Supports: An Alternative to Mass Housing*, trans. Ben Valkenburg (London: The Architectural Press, 1972), 12-13.
4. Alejandro Aravena and Andres Lacobelli, *Elemental: Incremental Housing and Participatory Design Manual* (New York: Distributed Art Pub Incorporated, 2012).
5. Daniel Miller, "Accommodating," in *Contemporary Art and the Home*, ed. Colin Painter (Oxford: Berg Publishers, 2002), 115.
6. Alison Blunt and Robyn Dowling, *Home* (London and New York: Routledge, 2006), 2.
7. Miller, 124.
8. Martin Heidegger, "The Thing" in *Poetry, Language, Thought,* trans. Albert Hofstadter (New York: Harper and Row, 1971), 161-184.
9. Nicholas John Habraken, *The Structure of the Ordinary: Form and Control in the Built Environment* (Cambridge, London: MIT Press, 2000), 60.
10. Miller, 124.
11. Nicholas John Habraken, *Supports: An Alternative to Mass Housing*, trans. Ben Valkenburg (London: The Architectural Press, 1972), 16.
12. Sheila Crane, "The Shantytown in Algiers and the Colonization of Everyday Life", in *Use Matters: An Alternative History of Architecture*, ed. Kenny Cupers (London and New York: Routledge, 2013), 103-120.
13. Moustafa A. Baghdadi, "Changing Ideals in Architecture: From CIAM to Team X", in *Architectural Knowledge and Cultural Diversity* (Lausanne: Comportements, 1999), 165-167.
14. Brittany Utting and Daniel Jacobs, "An Architecture without Contempt" *CARTHA* II, no.03 (2018): 12-14.
15. Sheila Crane, "The Shantytown in Algiers and the Colonization of Everyday Life", in *Use Matters: An Alternative History of Architecture*, ed. Kenny Cupers (London and New York: Routledge, 2013), 103-120.
16. Peter Kroes, "Design methodology and the nature of technical artefacts" Design Studies 23, no.03 (2002): 287-302.

A Computational Approach to Dwelling Activities

Visual grammars are powerful in documenting the spatial relations between the parts of a design system and their generative specifications. Terry Knight comprehensively documents shape transformations in the artistic creations of various historical periods.[17] Her approach looks at the design context. Similarly, visual rules in other studies are based on information from the site, previous designs, or future users' customization, and are utilized to create new designs—as in the case of Malagueira houses[18] and Vantongerloo paintings[19] —or to convert an existing design into one that fits contemporary use requirements, as in the cases of the Rabo-del-Bacalhau Apartments[20] and Hayat Houses.[21] Visual grammars have been expanding to incorporate studies of social space,[22] as well as those that include the user[23] or the maker.[24] In contrast to the existing studies, in terms of inferring visual rules, we explore the user context in depth by analyzing *Climat de France residents*' dwelling activities, their various modifications of the façade of *200 Colonnes*, and the residents' competences that are in line with the taskscape concept.[25] We introduce not an idealized methodology but frameworks to open up formal methods to social data by simply proposing channels for possible links between the users' needs and the design. The residents' home-making practices transform the architecture as part of a rehabilitation process from within. Grammar based approaches, which use the visual rules that are cited above, already support transformations of existing house types into new ones. The visual rules we infer are representative of how the existing transformations may have been generated.

Data Gathering

Visual materials that establish the basis for our methodology are collected through audio-visual media, archive documents, observations, and interviews. Archival documents are available at the "Les Pierres Sauvage de Belcastel" (PSB) association, which was created to preserve Fernand Pouillon's work. *Climat de France* was built during the harsh years of the war of independence between 1954-1957; therefore, documentation of the building process is scarce. There are no significant drawings; only several photographs of the construction site after the project's completion are available from PSB.

17. Terry Knight, "Regarding Rules: From Rimini to Rio" *JOELHO Digital Alberti: Tradition and Innovation* 5, (2014): 13-27.
18. Jose Pinto Duarte, "Towards the Mass Customization of Housing: The Grammar of Siza's Houses at Malagueira," *Environment and planning B: Planning and Design* 32, no. 3 (2005): 347-380.
19. Terry Knight, "Transformations of De Stijl art: the paintings of George Vantongerloo and Fritz Glarner" Environment and Planning B: Planning and Design 16, no. 1 (1989): 51-98.
20. Sara Eloy and José Pinto Duarte, "A Transformation Grammar for Housing Rehabilitation" *Nexus Network Journal* 13, no. 1 (2011): 49-71.
21. Birgül Çolakoğlu, "Design by Grammar: An interpretation and generation of vernacular Hayat Houses in contemporary context" *Environment and Planning B: Planning and Design*, 32, no.1 (2005): 141-149.
22. Teresa V. Heitor, José P. Duarte, and Rafaela M. Pinto, "Combing grammars and space syntax: formulating, generating and evaluating designs" *International Journal of Architectural Computing* 2, no. 4 (2004): 491-515; Eloy and Duarte, "A Transformation Grammar for Housing Rehabilitation" *Nexus Network Journal* 13, no. 1 (2011): 49-71; Ju Hyun Lee, Michael J. Ostwald, and Ning Gu, "A Combined Plan Graph and Massing Grammar Approach to Frank Lloyd Wright's Prairie Architecture" Nexus Network Journal 19, no. 2 (2017): 279-299.
23. Maria Da Piedade Ferreira, Duarte Cabral De Mello, and José Pinto Duarte, "The grammar of movement: A step towards a corporeal architecture" *Nexus Network Journal* 13, no. 1 (2011): 131-149; Theodora Vardouli, "Making Use: Attitudes to Human-artifact Engagements," Design Studies 41 (2015): 137-161; Sara Eloy, Maria Angela Dias, and Pieter Vermaas, "User-centered shape grammars for housing transformations: towards post-handover grammars" *SIGRADI Technopoliticas*, 22th Conference of the Iberoamerican society of Digital Graphics (2018): 1-9.
24. Benay Gürsoy and Mine Özkar, "Visualizing making: shapes, materials, and actions," *Design Studies* 41 (2015): 29-50; Terry Knight and George Stiny, "Making grammars: from computing with shapes to computing with things" *Design Studies* 41 (2015): 8-28; Terry Knight, "Craft, performance, and grammars" in *Computational Studies on Cultural Variation and Heredity*, *KAIST Research Series, ed. Ji Hyun Lee* (Singapore: Springer, 2018), 205-224; Rizal Muslimin, "Toraja glyphs: an ethnocomputation study of passura indigenous icons" *Journal of Asian Architecture and Building Engineering* 16, no. 1 (2017): 39-44.
25. Tim Ingold, *Perception of the Environment: Essays on Livelihood, Dwelling and Skills* (London, New York: Routledge, 2000), 178 and 190.

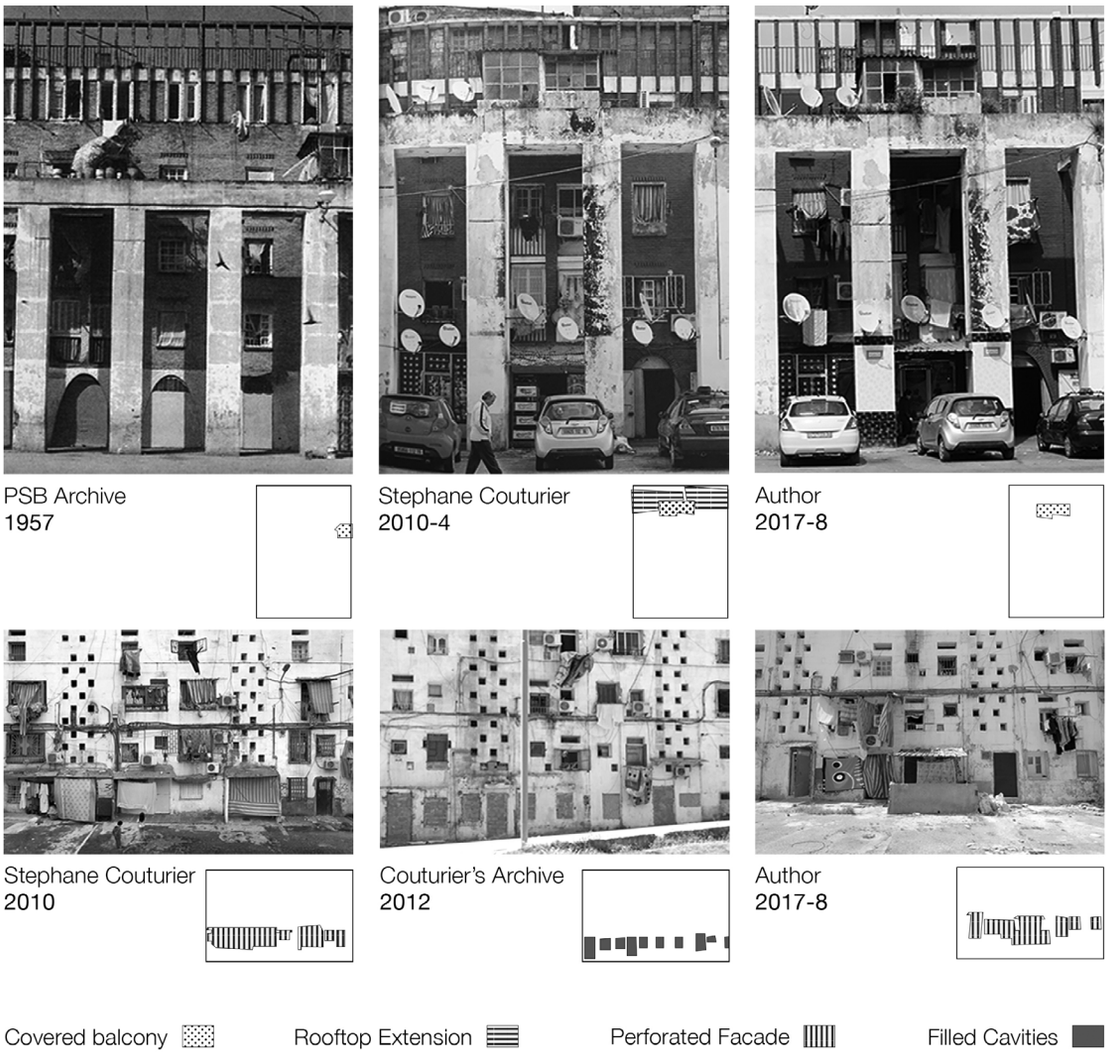
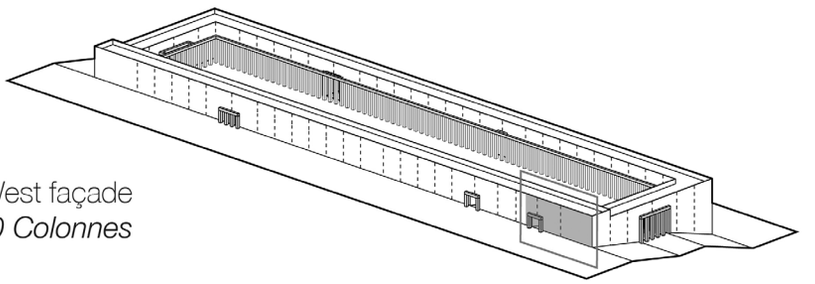


Figure 2. Photographs taken at different times show the continuity and discontinuity of residents' modifications. The photographs in the top row capture how rooftop extensions have diminished in 2017-8, and the ones below capture how the ground floor extensions have been regenerated in 2017-8 after being demolished in 2012.

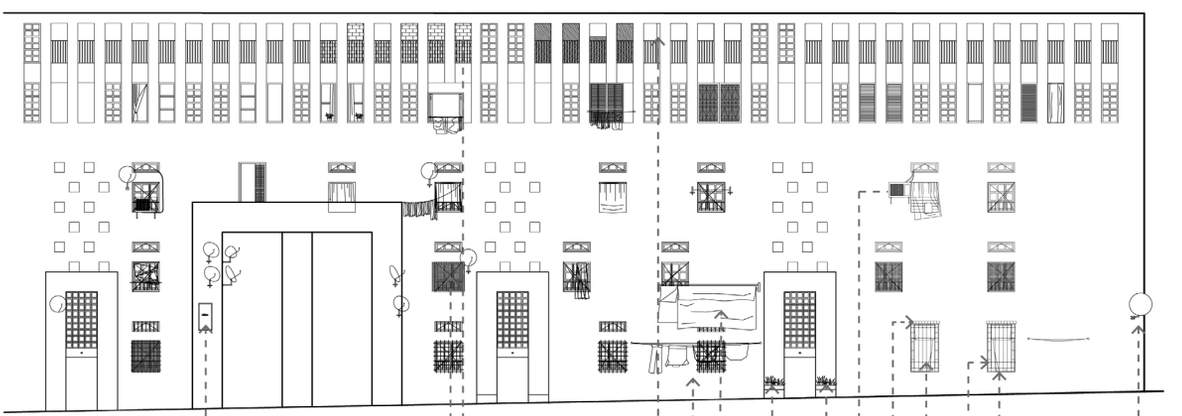
Numerous photographers raised awareness of social housing residents' dwelling practices in Algiers—and Fernand Pouillon's architecture in particular. A photograph that was taken shortly after residents moved into the *2oo Colonnes* demonstrates a covered balcony and is evidence of how early resident modifications started (Figure 2, top left photo, area depicted in dots). The photographer Stephane Couturier[26] has documented many kinds of resident interventions between 2010-2014. His photograph from 2010 shows the most populous period, and there are many extensions on the rooftops and extensive façade modifications (Figure 2, top middle photo, area depicted in horizontal stripes). The same image shows that all the balconies on the top floor have been covered (Figure 2, top middle photo, area depicted in dots). The most recent photograph, taken in 2017 from the same point of view, reveals that most of the rooftop barracks have been completely removed (Figure 2, top right photo, area depicted in dots) following the 2011 relocation of inhabitants by the Algerian authorities. Another photograph illustrates the municipality filled cavities that were created on the façade in previous extensions (Figure 2: the bottom middle photo, area depicted in solid color, and the bottom left photo, area depicted in vertical stripes). A photograph taken in 2017 shows that people continue to perforate the enclosed cavities and then reuse them (Figure 2, bottom right, area depicted in vertical stripes).

26. Stephane Couturier and François Cheval, *Alger, Climat de France* (Marseille: Arnaud Bizalion, 2014).



The South-West façade
of the *200 Colonnes*

a partial drawing from the modified façade



Dwelling Activities	Taskscapes
Daily Activities	Laundry
	Cleaning
	Napping
Setting Boundaries	Privacy
	Fences (security)
	Top Covering
	Defining entrance
	Separating rooftops
Enhancing Home Comfort	Air conditioning
	Satellite dish
Taking Care of the Environment	Gardening
	Painting
Renovating the Interior	Doors and windows
	Layout
	Decorating
Need of Space	Commercial
	Extra room on the ground level
	Extra room on the rooftop
	Invading basements

Figure 3. Top, a diagram of 200 Colonnes highlighting the façade studied. Bottom, a part of the south-west façade with the corresponding dwelling activities and taskscapes.

Climat de France has also been a subject dealt with by cinema. The 1977 film *Omar Gatlato*[27] depicts the struggle of a young Algerian man and his crowded family in a two-room apartment in *200 Colonnes*. Several videos from 2011 onwards[28] are accessible on the world wide web and illustrate housing-related demonstrations held in *Climat de France* to protest against the insufficient living conditions that have been ongoing for decades. The semi-structured interviews we conducted on site support the information gathered from photographs and films regarding the inadequate interiors, tight layouts, and the limitations to flexibility and change. These videos and interviews highlight the urgent spatial problems of daily life in *Climat de France*.

Systematizing

The data collected on *Climat de France* has led to a comprehensive set of drawings of the transformed façades in our work and a taxonomic set of dwelling activities that are addressed in the transformations as they answer the dweller's specific needs. In contrast to previous grammars, we do not infer rules from an ontology of the architectural elements transformed by the residents;[29] we instead infer them from the dwelling activities that result from the user context. The modifications made by the residents were all implemented while living in the building on a daily basis. Therefore, we adopt a dwelling perspective that "sees in every form the concrete realization of an intellectual solution to a design problem."[30] Based on the documentation of the residents' lives in various media, observations from site excursions, and a limited number of interviews, we match the visible modifications from the façades with a set of dwelling activities for which the residents of *Climat de France* have sought adaptations to the physical environment.

200 Colonnes offers a high number and variety of modifications that emerge in patterns in its repetitive spatial organization. Our study looks at the façades instead of the plans, which are commonly accepted as the generator of architectural space. In the case of *200 Colonnes*, façades are significant for both the plan and the modified interiors as they display residents' daring and outward expressions of spatial needs and cultural appropriations.

The patterns of dwelling activities can be broken down into seven categories, as shown in Figure 3: (1) daily laundry, cleaning, and napping activities, (2) setting boundaries such as privacy curtains, security fences, defining entrances, and separating rooftops, (3) enhancing home comforts such as installing air conditioning and satellite dishes, (4) taking care of the environment: gardening and painting, (5) renovating the interior: door and windows, layout and decoration, (6) addressing the need for space: commercial use, building an extra room on the rooftop or at ground level or using the basement, and finally (7) public space transformations such as installing or drawing a goal post, setting up a marketplace, and setting up a tent for funerals and weddings. This last category applies more to the interior façades of *200 Colonnes* rather than its south-west façade that we are studying. Categories range from long-term or permanent activities to short-lived or temporary activities, which emphasize the variety of the building's temporal character. Regardless of whether the activities physically impact the façade for one afternoon or years to come, each has a place in the user context. As much as being an answer to a design problem, each modification reflects local resources (i.e. materiality), capacities (i.e. skills, finances), visions, and desires. The representation in the grammar captures the visual outcomes of this user context on site. We use abstract two-dimensional drawings as tools to translate the collected data into a non-exclusive visual grammar. The visual rules of the grammar are shown in Figure 4. The numbering logic of the rule name

27. *Omar Gatlato*. Directed by Merzak Allouache, performed by Boualem Benani, Aziz Degga, and Farida Guenaneche (1977; Algiers: Office National pour le Commerce et l'Industie Cinematographique), Film.
28. "Climat de France," YouTube, March 30, 2018, https://www.youtube.com/watch?v=zDRrztGf4Sw
29. Sara Eloy, Maria Angela Dias, and Pieter Vermaas, "User-centered shape grammars for housing transformations: towards post-handover grammars" *SIGRADI Technopoliticas*, 22th Conference of the Iberoamerican society of Digital Graphics (2018): 5.
30. Tim Ingold, *Perception of the Environment: Essays on Livelihood, Dwelling and Skills* (London, New York: Routledge, 2000), 186.

Rn.m is that the first number *n* refers to a particular taskscape whereas the second m stands for a unique modification. Reverse modifications are represented with the prime symbol, e.g. Rn.m'. Visual rules capture the before and after conditions of the façade elements, respectively, on the left and right sides of the arrow. For each visual rule, text labels present the visual modifications with information on the dwelling activity, the taskscape, the tools and skills required, cost competences, and the impact on the building. Due to a lack of space, text labels are not given for the entire set in Figure 4 but an example set is listed for the computations in Figure 5. We conjecture the gradation of skills (i.e. no tools, small tools, professional skills, or constructional skills) and of costs (i.e. no, low, mid-low, mid, mid-high or high costs). Based on the materials used and construction techniques, we identify their impact on the building and analyze the buildings' retrieval (i.e. no damage, low damage, high impact damage, or irreversibly damaged).

The grammar embodies the changing attributes of the original design from the users' point of view, as well as the residents' skills and the cultural appropriations. To provide an example, let us focus on the resident modifications in Apartment 3 from Figure 5. Based on collected data, this apartment has been majorly renovated with mid-high cost adaptations. The skill and cost competence of this apartment's residents, and probably their socio-economic level, is relatively high in comparison to the other residents in the same block. They are also the only ones expanding the interior renovations to the exterior through the application of R20.1. The desire for excessive privacy that can be seen in the application of both R4.1 and R6.1 is an indicator of their

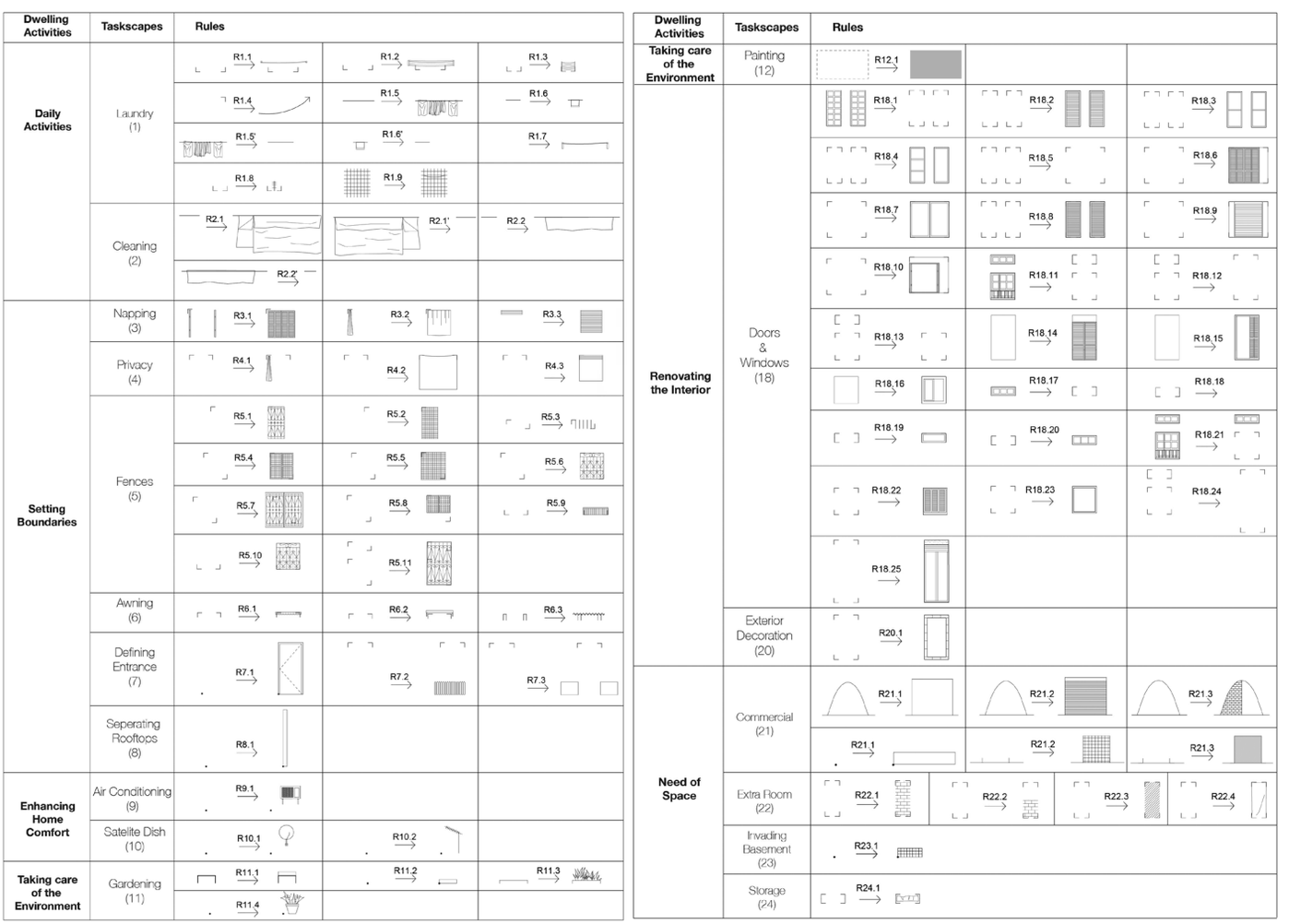


Figure 4. The residents' modifications identified on the south-west façade of 200 Colonnes are shown with corresponding visual rules and are classified according to the dwelling activities and the taskscapes.

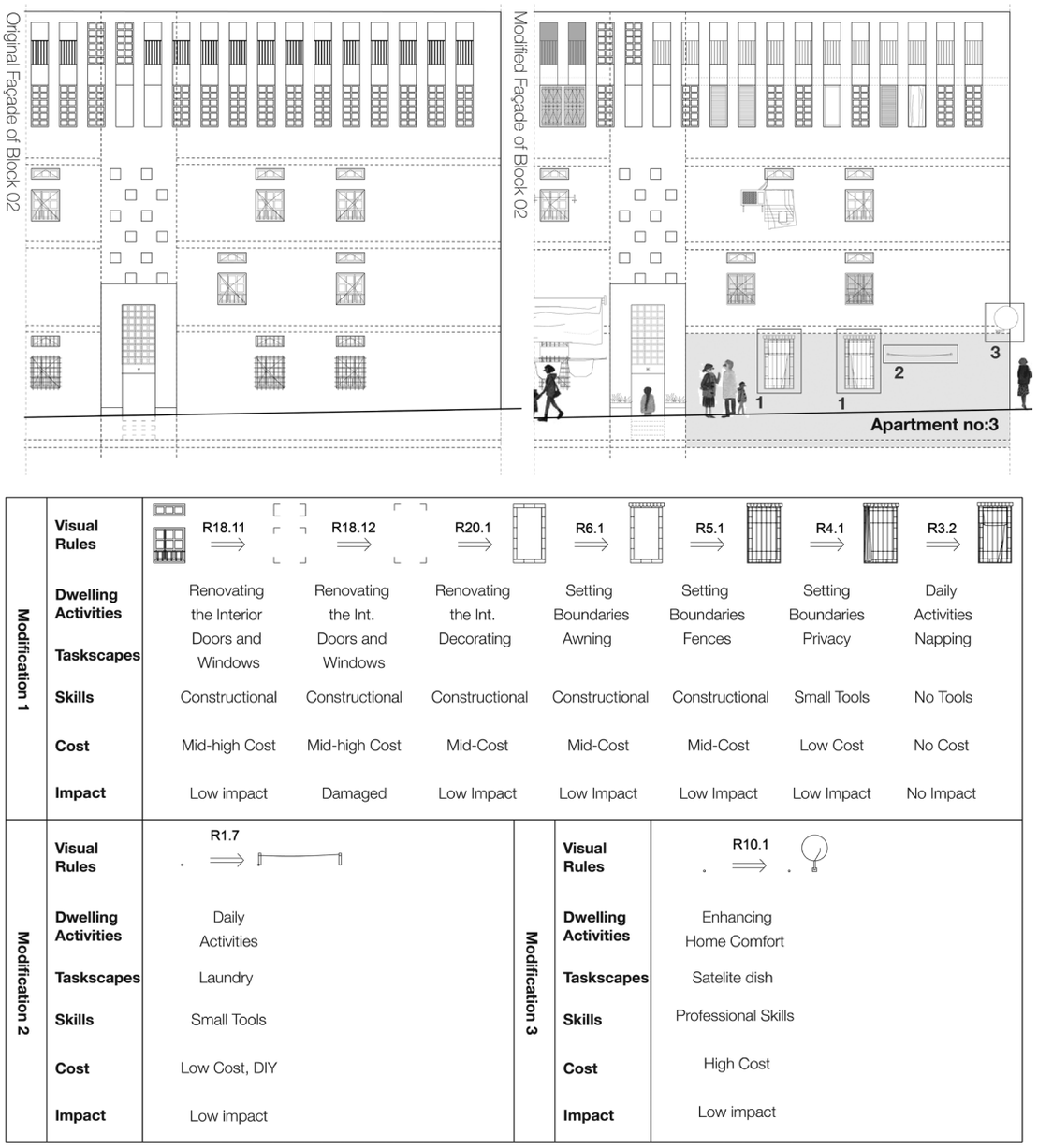


Figure 5. Drawings of the original façade of Block 02, top left, and the modified façade of Block 02, top right. The visual computation (with text labels) for residents' modifications in Apartment 3. The numbers next to the drawing of Apartment 3 in the top right corner indicate where the modifications are visible on the façade.

religious conviction, and the orientation of the satellite dish in the application of R10.1 reveals which culture and geography the apartment residents follow through TV stations. All this information is embedded in the inhabited forms and retrieved through formal methods. Visually acquiring this kind of detailed information for the entire block or the settlement provides a database of multiple temporalities for the inhabited *Climat de France*. From this database, it is possible to identify repetitions and variations to attest to how the users have "lived" in different parts of the façades over time and understand what patterns exist overall.

Conclusion

To incorporate the user context and formal analysis, we have established the visual rules of an inhabited environment. The discrepancy between the fluid world of socio-cultural acts of the user and idealized forms have long been a subject

31. Stewart Brand, *How Buildings Learn* (New York: Penguin Books, 1994), 2.

matter in architectural theory.[31] In this paper, the focus has been on exploring the potential of visual rules to identify, characterize, and classify the user context. The visual material gathered from archives, films, and photography limits what the grammar represents. Nonetheless, the visual and physical manifests help us learn about the users' social capacities and desires, their locality, and their past use so we can understand the transformations of how the built form moves towards its future use. Our approach speaks to both the formal methods as well as the discursive social sciences. Sets of visual rules are inferred outside a laboratory setup and could produce more significant results once combined with all-inclusive interviews and surveys rather than the limited number of short semi-structured interviews we conducted with the inhabitants. The rules are also inferred from visual data and are abstractions that allow for subjective interpretation of said data by any stakeholder, e.g. user and/or designer. The advantages of insisting on the visual character of the analysis are in the documentation of various aspects of modifications which residents and field researchers may overlook. The patterns recognized with the proposed approach establish a visuo-spatial ground to orient and guide researchers in their interviews and surveys.

Maintaining a critical distance from the historical epistemology of CIAM Alger, and from more recent attempts at mapping residents' needs to architectural solutions, we seek a possible linkage between the design context and user context. The case of *200 Colonnes* shows that the local trends, cultures, and ways of life constitute *other* patterns within an architectural system. Enhancing formal methods with information on the users and their dwelling patterns reinforces the temporal character of the form and the capacities of architectural systems for purposes rehabilitating mass housing.

A future direction of this approach —digital automation of visual data interpretation— may better utilize the computational potential of representing the user context this way. It can enable faster detection of transformations in larger data sets to analyze user's wishes and competences in future rehabilitations. If automated, i.e. if grammar rules are automatically recognized and drawn out from processed images and building scans, the approach can reach its full potential in documenting the user context. Computer vision algorithms may capture different levels of detail from documentary films and photography to speed up this process for larger data sites.[32]

The 2019 Mies Van Der Rohe Award winner, the Grand Parc Bordeaux project,[33] is a housing renovation that transformed fully occupied dwellings. Residents of mass housing complexes are not excluded or isolated from the architectural and constructional processes like they used to be. In the colonial context of modern mass housing (such as in Algiers), residents' modifications are rich signifiers of the users' response to oppressive directives for living.[34] The rules of homemaking practiced so far in *Climat de France* are reference points for future use. While the set and level of skills used draw a framework for the economic and material limitations, the impact of modifications on the original building informs and draws limits for minimum permanent destruction. Looking at residents' modifications in colonial architecture with visual computational tools is an attempt to democratically untangle the "dense network of semantic exchange"[35] that inhabited architecture embeds. User empowerment through inclusive data collection and data design as well as accessible and interpretable representations have the potential to lead to sustainable rehabilitation and reuse in derelict masterpieces of colonial modernism.

32. Peter Galison, "Visual STS", in *Visualization in the Age of Computerization*, ed. Carusi, Annamaria, Aud Sissel Hoel, Timothy Webmoor, and Steve Woolgar (Routledge, 2014), 197-225.
33. "Transformation of 530 dwellings - Grand Parc Bordeaux," EUMiesaward, accessed September 30, 2019, https://miesarch.com/work/3889.
34. Jean Luis Cohen. "Architectural history and the colonial question: Casablanca, Algiers and beyond" *Architectural History* 49 (2006): 349–368.
35. *Ibid*.

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