# PLANTATIONS IN SÃO TOMÉ AND PRINCIPE: SPATIAL LAYOUT AND INDUCED BEHAVIOURS

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## INTRODUCTION

In the 16th century, Portugal established in São Tomé and Principe one of the most productive plantation economies in the tropics based on slave labour and sugar intensive monoculture. Later, from the mid-19th century to 1975, large plantations called Roças were developed to produce coffee and cocoa for highly profitable export production. As a result, at the beginning of the 20th century, São Tomé and Principe was the biggest exporter of cacao in the world. In these plantations, thousands of indentured workers were employed. As a result, roças embody the traces of merciless labour conditions[1] and a spatial organisation designed for the privilege of Europeans and their hegemony.[2]

Nowadays, roças serve several purposes, ranging from luxurious hotels to houses of large communities in squatters, and still, several roças are in ruin, being consumed by nature. The analysis of this heritage is relevant since these settlements can be future-directed legacies, which can contribute to a global cultural overhaul and sustainable development. A comprehensive overview of this context allows us to understand the past and the present, considering tangible and intangible values embodied by these heritage plantations. Critical and diachronic studies on the colonial and contemporary heritage are integrated by investigating the spatial layout of roça Agostinho Neto and roça Água Izé in their original design and as they are today. Roças were initially designed to be isolated and hierarchical[3] to optimize the production process and the trade export. Their original spatial organisations aim at segregating some of their inhabitants, while their territorial location makes them isolated regions inside São Tomé Island. This study aims to identity how the physical environment of roças have influenced and still influences human experience and behaviour and support the thesis that these settlements were designed hierarchically. Sensory access, behavioural affordance, and sociality are discussed by integrating critical perspectives arising from on-site observations and social surveys collected in November 2021 and coupled with the space syntax analysis.[4]

## ROÇAS IN SÃO TOMÉ AND PRÍNCIPE
### Brief historical overview and original spatial organisation

Roça[5] is a large-scale agro-industrial estate structured by a series of settlements, headquarters, and dependencies, designed to maximize the profit deriving from the crop production process.[6] These settlements were multifunctional complex that included groups of houses, large agro-industrial constructions, and supporting facilities. This vast heritage (two hundred roças exist in the country) derives from European architectural and structural patterns adapted to the tropical environment. Distinct cultures and roles characterise each social group living in Roças across time.
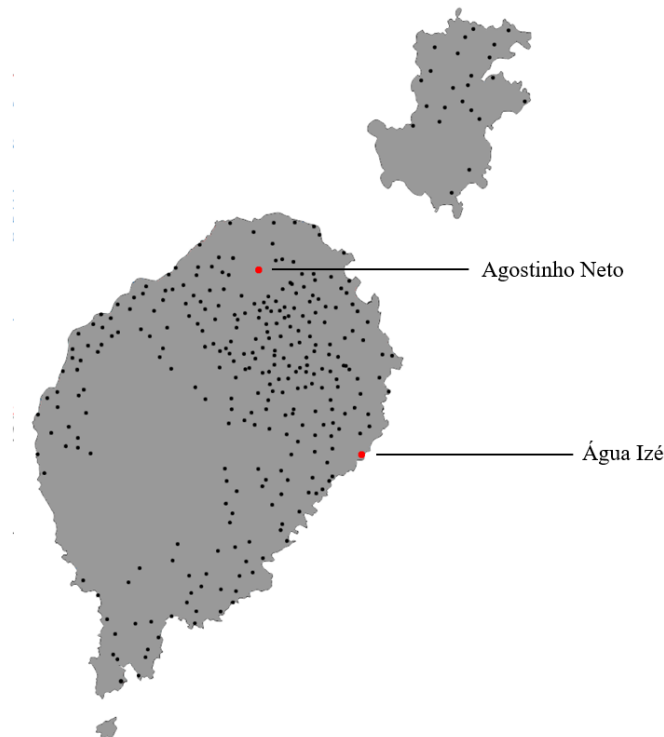
*Figure 1. Location of roças in São Tomé and Príncipe*

Although roças follow a similar spatial organisation, each has different dimensions, depending on the territorial context in which they are established and their role in the whole plantation system. In more detail, their spatial layout differs according to their use and connections between the headquarter and dependencies and their position next to the coastline (used as dock and port areas) or in the inland (mainly used to settle the plantation lands, house workers and the machinery close to the plantations). Although these differences exist, all roças follow a spatial organisation, where the same fundamental elements are present. There are usually five main functional areas: the administration area, the area where the workers lived, the area for the production facilities, the area for other facilities, and the open-air square - terreiro. The administration area generally includes a group of buildings, such as the house of the owner, the house of the administrator, and the house for the foremen and offices. The area lived by workers includes their houses, the sanzalas, and communal facilities such as washing and sanitary areas. The third area comprises all the buildings related to production, namely warehouses, dryers, greenhouses, workshops, carpentry, and metalwork workshops. The larger roças also include other equipment usually built after the beginning of the 20th century, such as hospitals, chapels, and schools. The terreiro was a central empty area in the settlement with a symbolic role since it was where workers were joined to be counted before and after the work in the plantations, or where the beans were dried.[7] Roças were designed to be as much as possible self-sustainable.

The experience of the roça is largely characterised by the imposed and clear social hierarchy, manifested by its spatial structure, the architectural style used, and the construction systems adopted, related to the four areas referred to before. The spatial organisation of the roças required an adaptation to the existing territorial conditions, either in physical terms since several of them occupy sloping terrain, or in the formalisation of the social relationships that were established between low hierarchical workers (enslaved people and forced contracted[8]) and the other groups in the settlement, namely specific workers, usually coming from the city of São Tomé, and higher position workers as foreman and administrator, typically Portuguese.

**Roça Agostinho Neto**

Roça Agostinho Neto is situated in steep terrain in the north of the island, distancing 14 km from the city of São Tomé and 5 km from the coastline. This roça was the headquarters of an estate with more 14 dependencies, owned by the Sociedde Agrícola Valle Flôr, and it is considered the country's most representative roça.[9]

The original layout of Agostinho Neto was developed around four zones.[10] the first including the hospital and the chapel, at the higher altitude and at one of the edges of the settlement; the second, on the opposite top of the settlement and lower more than 20 meters, with the house of the owner, administrator and foremen presenting a lower building density; the third zone occurs on both sides of the avenue and includes the sanzalas distributed along different platforms connected by staircases; the fourth locates in between the second and the third and consists of the offices of the company and other technical areas. Its layout is characterised by the central axis, with 470x80 meters, that crosses the entire settlement[11] (see Figure 3). In 1924 Agostinho Neto had 2,500 workers.

Nowadays, several new constructions are spread throughout this settlement: i) attached to the existing buildings, e.g., to the sanzalas; ii) not attached and within its original perimeter; iii) and outside of the original roça area (see Figure 2 and Figure 3). The area with the highest building density is the one surrounding the sanzalas; among these houses, several new types of houses and facilities were built. Due to the large size of this roça, the newly built solutions are very diverse. In the last ten years, a large number of new constructions has been built, distancing observations derived by the surveys carried out by Fernandes and Silva[12] to our off- and on-site analysis in 2021-2022 (Figure 3).



*Figure 2. Present-day occupation in roça Agostinho Neto: in front of the owner's house (left) (photo by Rui Brito); sanzalas and their extensions (right) (photo by Sara Eloy)*
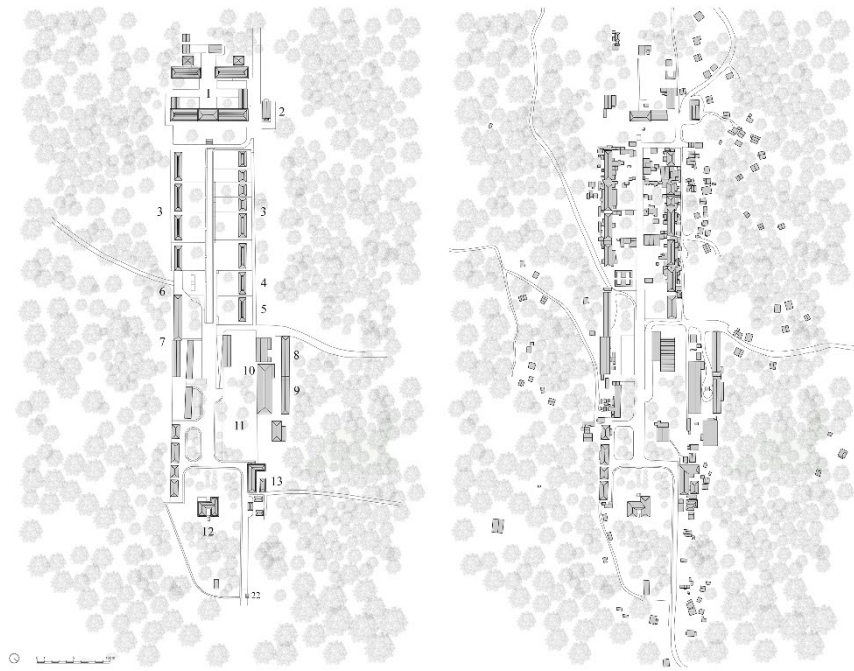
*Figure 3. Roça Agostinho Neto: original layout (left); nowadays layout (right)*
*1 - Hospital; 2 - Chapel; 3 - Sanzalas; 4 - School; 5 - Nursery; 6 – Washing area; 7 - Offices; 8 - Warehouses; 9 - Workshops; 10 – Drier; 11 – Terreiro; 12 - Owner's house; 13 – Foremen and European workers houses*

## Roça Água Izé

Roça Água Izé is distancing 17 km from the city of São Tomé, and its location, close to the coast, facilitates it to turn into one of the most profitable roças in the country.[13] This roça was the headquarter of an estate with 14 more dependencies and owned by Companhia da Ilha do Príncipe. In 1908 this roça employed circa 2,500 workers.

The original layout was adjusted to the land's natural slope by implanting the buildings on three altimetric levels, parallel to the coast (northeast/southwest).[14] According to Silva,[15] this roça's design intended to establish hierarchy among those who lived and worked there. The housing sector of the roça on the southwest side of the roça is divided into two zones. The first zone, to the west and more inside the land, was for the sanzalas, which are located on different uneven platforms and are organised according to modular sets. The second zone in the south, closer to the sea and the main road, was the house of the administration and owner, surrounded by constructions that assure the privacy of the place.[16] From this house, it was possible to look at all the roça, especially the terreiro and the sanzalas, to control the activities there. The production facilities are located in the northeast of the settlement. The symbolic radial-arranged hospital is located in the southwest in a steep area apart from the rest of the settlement.

*Figure 4. Present-day occupation in roça Água Izé: sanzalas and recent extensions (left) (photo by Sara Eloy); the current use of the terreiro (right) (photo by Rui Brito).*



*Figure 5. Roça Água Izé – original layout (left), nowadays layout (right)*
*1 – Owner's house; 2 – Administration house; 3 – Foremen house; 4 – Offices; 5 – Old Hospital; 6 – New Hospital; 7 – Clinic staff house; 8 – Sanzalas; 9 – Warehouses; 10 – Workshops; 11 – Stable; 12 – Drier and factory; 13 - Terreiro*

Also, in roça Água Izé nowadays, several new constructions are spread throughout this roça and in the same three situations: attached to the existing buildings, e.g., to the sanzalas; not attached but inside the original roça area; and outside of the original roça area (see Figure 4 and Figure 5). Because this roça is smaller than Agostinho Neto, the larger group of new constructions is outside the original layout. Figure 5 (right) shows many new blocks adjacent to the sanzalas, built east of the original settlement. Comparably to what is observed in Agostinho Neto, inhabitants have also constructed extensions to the existing buildings and have demarcated outdoor areas of influence. Nowadays, the hospitals are close to collapse, although they are still used as housing, and the industrial facilities in the northeast are almost abandoned or occasionally used[17].

## PATTERNS OF CURRENT OCCUPATION IDENTIFIED DURING OFF- AND ON-SITE SURVEYS

After the independence of São Tomé and Príncipe in 1975, roças became the property of the state. In the last decades, roças have shown extraordinary resilience in various solutions since these constructions turned into refurbished luxury hotels, museums, local businesses, or becoming squatted settlements. At the same time, few settlements are still used for cacao plantations. Other roças, endangered by neglect and shortage of funds, are still useless skeletons close to being lost in time. Yet, by becoming entangled with local cultural and economic structures, these plantations harbour the promise of a future-directed legacy meaningful to global culture and development. Especially in the roças that have become squats, several alterations were accomplished. The alterations are done in the spatial layout of roças following three types of action, according to Ana Fernandes.[18] i) expansion of the habitable space; ii) construction of new houses next to the existing built-up areas; iii) demarcation of outdoor areas of influence.

In both roças, Agostinho Neto and Água Izé, all these three types of alterations took place, mainly around the sanzalas (types i, ii and iii) and outside the original perimeter of the roças (types ii and iii). Água Izé is nowadays lively, and, likewise Agostinho Neto, most of the community gathers around the original building blocks and much less around the original central areas since they lost their aggregator, yet controversial role.

The permanence of the use of terreiro as it was conceived (meeting un-built place) seems to be an option that the local communities are taking, almost as if now this place remains a symbol of the previous controversial times.

## INFLUENCE OF SPATIAL LAYOUT ON THE EXPERIENCE AND BEHAVIOURS OF INHABITANTS

### Space syntax and spatial patterns of roças

Architecture structures the space we live in and directly relates to social life.[19] Buildings and the space between them allow people to move or force them to stop, encounter others, or be isolated. Space syntax was introduced by Bill Hillier, Julienne Hanson, and colleagues at The Bartlett, University College London in the late 1970s to early 1980s to enable an analytical analysis of the relations between space and society.

Since the 70s several studies using this theory have been performed on different types of built environments, from cities to villages, neighbourhoods, and buildings.[20]

To understand how the spatial organization influences the behaviour, we first needed to identify a spatial pattern in the original roças and analyse if that pattern can support the thesis that these settlements were designed hierarchically. Additionally, we analysed the current layout of the two roças to identify how strong those patterns are and if they were altered with the recent new constructions. We calculated integration and connectivity measures using visibility graphical analysis (VGA).[21] Integration usually indicates "how many people are likely to be in a space and is thought to correspond to rates of social encounter".[22] At the same time, connectivity "measures the number of immediate neighbours that are directly connected to a space".[23] We observed that the limits of the original and current settlements differ in one case more than the other. Indeed, the settlement around Água Izé is much more extensive nowadays than originally, and this difference is not so pronounced in Agostinho Neto. So that the analysis would represent the settlement at the moment to be studied, we opted to analyse a different perimeter – original and present-day - of each roça.

**Roça Agostinho Neto analysis**

The analysis carried out by Silva[24] about the hierarchical design of Agostinho Neto can be supported by the space syntax analysis here presented.

Figure 6 (left) shows the integration analysis, and Figure 7 (left) shows the connectivity analysis of the original design. It is verifiable that the crossing between the avenue and the street that connect the houses of the owner, administrator, and foreman is the area with higher integration and connectivity. This means that this is the place in the settlement with a higher potential to be a destination for movement and with a high number of connections departing from and to it. In an opposite tendency, we can observe that the areas where workers live, sanzalas, have low integration and connectivity values. Likewise, the terreiro has a level of connectivity higher than the sanzalas and lower than the control area of the owner and administrator. This is because the terreiro needed to be easily accessible but not more than the spaces controlling it. Such results support the thesis of roça being closed within itself and hierarchical structure.[25]

As mentioned before, new constructions were built within the perimeter and in the near surrounding areas of this roça. The boundaries of this roça remain unchanged since the new structures of this settlement did not spread much outside the original perimeter.

When comparing the original to the current layout, it is identifiable that the old dynamics are similar to the current ones. The most significant difference was the enlargement of the perimeter on the southwest of the settlement. By creating new fringes of the roça, the areas with a large potential for movement (the most integrated areas) are now the ones in the north of the roça, previously areas of plantation (Figure 6, right). This result does not say much about the living dynamics inside the old structure that remained almost the same. When analysing the connectivity of the settlement, we can observe that the same hierarchy is maintained nowadays even if a new extension exists in the southwest (Figure 7, right). A relevant modification was the addition of a building on one of the sides of the terreiro that negatively impacted the integration of such area (see Figure 6, right). This addition is uncommon in most of those roças analysed in literature[26] and as verified through our on-site survey.



*Figure 6. VGA analysis – Integration of Roça Agostinho Neto: original layout (left) and present-day layout (right)*
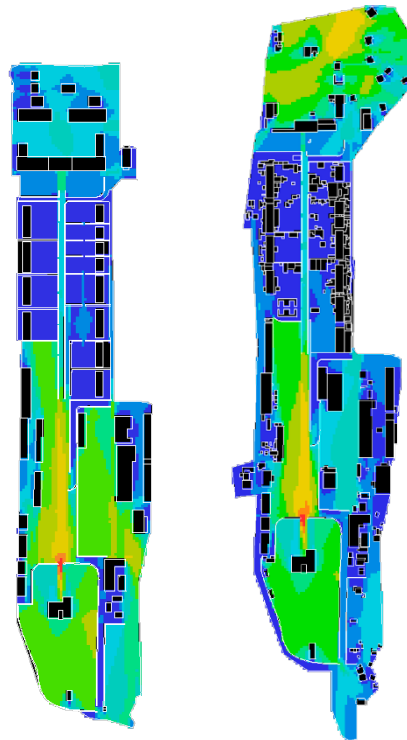
*Figure 7. Integration VGA analysis – Connectivity of Roça Agostinho Neto: original layout (left) and present-day layout (right)*

**Roça Água Izé analysis**

Similarly to the previous case study, the analysis carried out by Silva[27] about the hierarchical design of Água Izé can be supported by the space syntax analysis here presented. On the one hand, the study of the integration measure in the original design (Figure 8, left) shows that the area around the owner's house and the terreiro are the more integrated ones and the ones with higher connectivity. This means that these areas have a large potential to be a destination for human movement and that there are a high number of connections departing from and to them. On the other hand, the area around the sanzalas and close to the two hospitals present low levels of integration and connectivity and therefore less potential to attract movement or to be visited.

When comparing the original layout to the current one, it is identifiable that by enlarging the area of roça, most of the initial dynamics have changed. Indeed, by creating new fringes of the roça, the areas with a large potential for movement (the most integrated areas) are the ones northeast of the roça, previously serving as plantation land (Figure 8, right). Also, the densification of the buildings of sanzalas by constructing new houses adjacent to the existing ones reduced the connectivity there, increasing the sense of segregation in these areas (Figure 9, right).

As mentioned before, one interesting phenomenon observed in Água Izé (as in other roças) was that the original terreiro has been maintained, in most cases, as it was initially conceived, without any occupation by new other constructions or any alterations of its original spatial form. This permanence in the spatial layout is visible in Figures 8 and 9 (right), which show that this previously dominant place is still losing its importance as an aggregator of the roça.
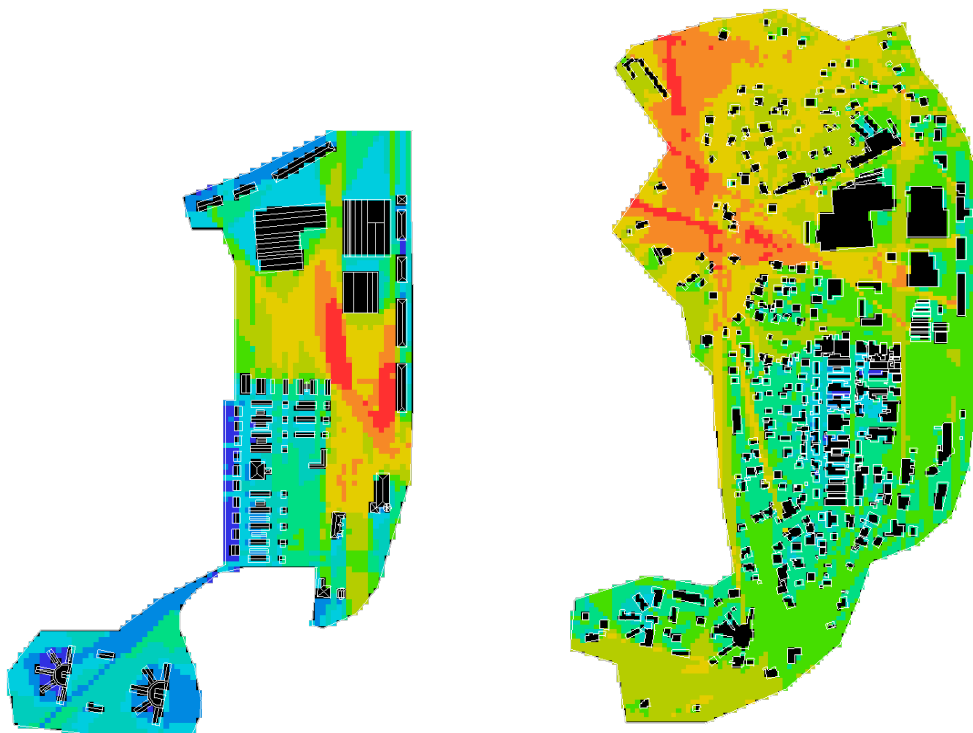
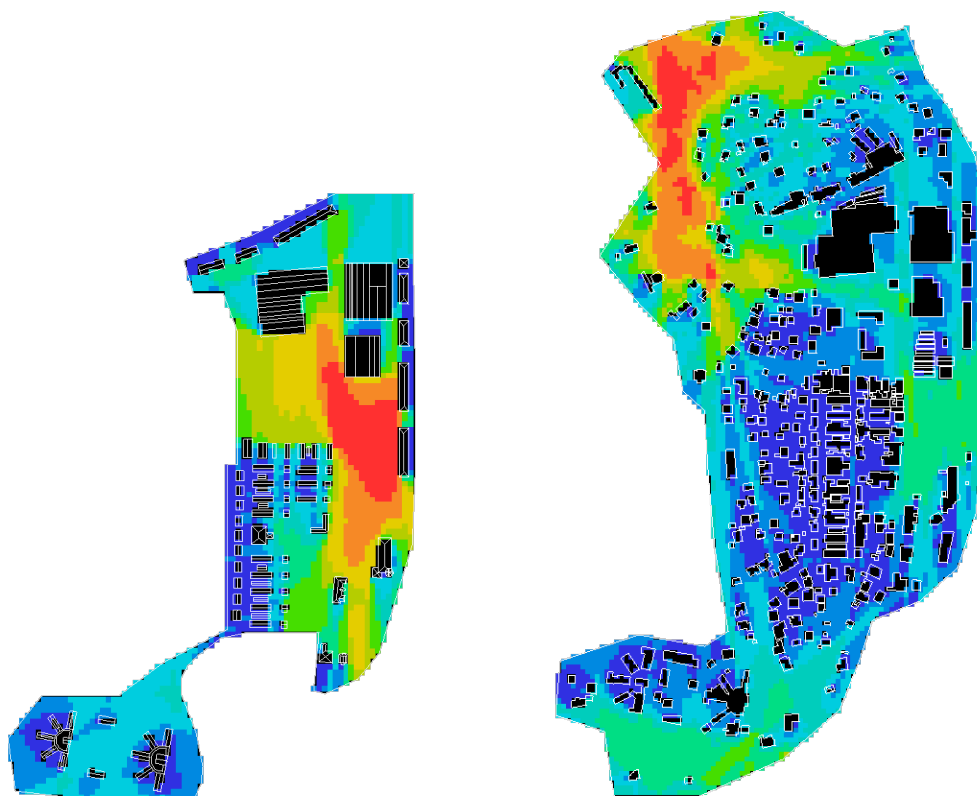*Figure 8. Roça Água Izé VGA analysis – Integration. Original layout (left), and present-day layout (right)*



*Figure 9. Roça Água Izé Integration VGA analysis – Connectivity. Original layout (left), and present-day layout (right)*

**CONCLUSION**

This paper presents an exploratory study whose aims is to identify patterns of spatial layout in the roças of São Tomé and Principe, that can support the claim that these settlements were built following a hierarchical social structure.

An analysis of two representative roças was developed using space syntax method. Results show a tendency to prove the hypothesis that roças were designed hierarchically to strengthen social differences among the inhabitants of the roças. The areas dedicated to housing workers – sanzalas – present low levels of integration and connectivity, showing that those were places where social encounters were to be avoided and kept to minimal. On the contrary, the houses of the owner and administrator are positioned in areas that displays higher levels of integration and connectivity to increase the control over the entire space and its occupants. After almost 50 years of independence and some restructuring of these roças, the original patterns are maintained and, in some cases, the connectivity become worst. Results suggest that there is a pattern of imposed social life in the spatial organisation related to the topological configuration of the two analysed roças.

**ACKNOWLEDGEMENTS**

## NOTES

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[2] Hugo Machado da Silva, "Roça de São Tomé e Príncipe. Génese, Processo e Lógicas Espaciais" (Universidade do Porto, 2018); Augusto Nascimento, *Poderes e Quotidiano Nas Roças de S.Tomé e Príncipe de Finais de Oitocentos a Meados de Novecentos.* (Lisbon, 2002).

[3] Emiliano Dantas, "A Imagem Enquanto Leitura e Escrita Do Mundo-O Leveleve e a Ferida Colonial" (ISCTE - Instituto Universitário de Lisboa, 2021); Silva, "Roça de São Tomé e Príncipe. Génese, Processo e Lógicas Espaciais."

[4] Daniel R. Montello, "The Contribution of Space Syntax to a Comprehensive Theory of Environmental Psychology," in *6th International Space Syntax Symposium* (Istanbul, 2007), 1–12; Bill Hillier and Julienne Hanson, *The Social Logic of Space* (Cambridge: Cambridge University Press, 1984).

[5] The term 'roça' means a place where weeds are cut, a clearing, and a place with crop plantation agriculture.

[6] Silva, "Roça de São Tomé e Príncipe. Génese, Processo e Lógicas Espaciais."

[7] Silva.

[8] The labour system in roças of São Tome and Príncipe was based on 'perpetually indentured' and "almost identical to slavery, which in law, was abolished in 1875. (…) There labourers were technically freed after purchase, but they were forced to acquiesce to long contracts which were 'automatically renewed' on expiry (…) they were brought to São Tomé and Principe against their will and were not repatriated. (…) The children of these labourers were born into 'perpetually indentured' (…)". William Gervase Clarence-Smith. "Labour Conditions in the Plantations of São Tomé and Príncipe, 1875 – 1914." Slavery and Abolition 14, no. 1 (1993): 149–67. https://doi.org/10.1080/01440399308575088.

[9] Roça Agostinho Neto (named roça Rio de Ouro before São Tomé and Principe independence) was founded in 1865 and acquired in 1903 by José Luís Constantino Dias who performed substantial changes to the previous existing settlement. Silva. "Roça de São Tomé e Príncipe. Génese, Processo e Lógicas Espaciais."

[10] Silva

[11] Silva

[12] Ana Silva Fernandes, "Entre Remediar e Solucionar. A Estruturação e a Aparticipação Como Meios de Gestão Da Escassez e Ruptura Do Ciclo de Pobreza. São Tomé e Principe Como Laboratório." (Universidade do Porto, 2015); Silva, "Roça de São Tomé e Príncipe. Génese, Processo e Lógicas Espaciais."

[13] Roça Água Izé was founded in 1854 by João Maria de Sousa Almeida, the 1st Baron of Água Izé (Silva 2018).

[14] Silva, "Roça de São Tomé e Príncipe. Génese, Processo e Lógicas Espaciais."

[15] Silva.

[16] Silva.

[17] In one of the original industrial buildings a new association FACA (Fábrica das Artes Ambiente Cidadania Activa / Fabric of the Arts, Ambient and Active Citizenship) was installed. This association is part of a large project created in 1995 by João Carlos Silva and Isaura Carvalho – Associação Roça Mundo – that by 2002 turned to be a foundation. Within this project several initiatives were created as CIAC (Centro Internacional de Arte e Cultura/ International Center of Art and Culture) in 1994, CACAU (Casa das Artes, Criação, Ambiente e Utopia/House of the Arts, Creation, Ambient and Utopia) in 1995 and the Bienal de Arte e Cultura de São Tomé e Príncipe, whose 1st edition was in 1995. FACA aims at recovering the roças and bring the population back from the urban peripheries to the roças, through the implementation of sustainable actions that promote economic and cultural development, such as art, crafts, ecotourism, or cultural tourism. Information available at
http://arquipelagoscriativos.unidcom-iade.pt/?page_id=543

[18] Fernandes, "Entre Remediar e Solucionar."

[19] Hillier and Hanson, *The Social Logic of Space*.

[20] Work by Sam Griffiths show the opportunities that space syntax analysis bring to historical research on space and society. See Sam Griffiths "The Use of Space Syntax in Historical Research: Current Practice and Future Possibilities." (*Proceedings 8th International Space Syntax Symposium*, 8193:1-8193:26, 2012). At the scale of buildings interesting work by Bill hillier and Tahar Bellal. See: Bill Hillier, et al. "Ideas Are in Things: An Application Oof the Space Syntax Method to Discovering House Genotypes." Environment and Planning B: Planning and Design 14 (1987): 363–85; Tahar Bellal. "Understanding Home Cultures through Syntactic Analysis: The Case of Berber Housing." *Housing, Theory and Society* 21, no. 3 (2004): 111–27.

https://doi.org/10.1080/14036090410000471. In the scope of this study relevant references are Loureiro et al.( Vânia Raquel Teles Loureiro et al., "Configuration of Self-Organizing Informality: Socio-Spatial Dynamimc in Favelas," (*Proceedings of the 11th Space Syntax Symposium*, 2017, 86.1-86.1).), Bellal (Bellal Understanding Home Cultures through Syntactic Analysis) and Griffiths (Griffiths "The Use of Space Syntax in Historical Research:).

[21] Visibility Graph Analysis (VGA) "investigates the properties of a visibility graph derived from a spatial environment. The VGA can be applied to two levels, eye level for what people can see, and knee level for how people can move which is critical to understand spatial layouts." Turner, A., M. Doxa, D. O'Sullivan, and A. Penn. "From Isovists to Visibility Graphs: A Methodology for the Analysis of Architectural Space." *Environment and Planning B: Planning and Design* 28, no. 1 (2001): 103–21. https://doi.org/10.1068/b2684.

[22] Kinda Al_Sayed et al., *Space Syntax Methodology* (Bartlett School of Architecture, UCL, 2014), 15, https://doi.org/10.1017/CBO9781107415324.004.

[23] Al_Sayed et al., 15.

[24] Silva "Roça de São Tomé e Príncipe. Génese, Processo e Lógicas Espaciais."

[25] Silva.

[26] Silva.

[27] Silva.

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